An Ecological-Transactional Analysis of Children's Sleep Problems following the Christchurch and Kaikoura Earthquakes: A Qualitative Study in the Context of Clinical Reasoning

A thesis in partial fulfilment of the requirement for the Degree of

Master in Science in Child and Family Psychology

At the University of Canterbury

By Sophie Hallam

2018

University of Canterbury, New Zealand

Table of Contents

List of Tables

Acknowledgements

I would like to thank my primary supervisor Karyn France for your guidance, knowledge and encouragement. Your extensive support and assistance throughout this process has been invaluable. I would also like to thank my secondary supervisor Kathleen Liberty for providing additional feedback and for assisting with the recruitment process. Thank-you to my family for your continued support, and friends who provided much needed breaks. Finally thank-you to my office mates, for your chats, distraction and late-night study sessions.

Abstract

Following a natural disaster, children are prone to various reactions and maladaptive responses as a result of exposure to a highly stressful and potentially traumatic event. Children's responses can range from an acute stress response to post-traumatic-stress disorder or may fall somewhere in between. While responses to highly stressful events vary, a common finding is that children will develop sleep problems. This was found following the Christchurch September 2010 and February 2011 earthquakes.

The purpose of this study was to investigate the context and phenomenology of the sleep problems of a small number of children experiencing these and the 2016 Kaikoura earthquakes, including possible mechanisms of effect. Participants were four families, including four mothers, one father and four children. The design of this study was unique. Interview data was subjected to a content analysis, extracted themes were organised according to an ecological-transactional framework and then the factors were subject to an analysis, based on the principles of clinical reasoning, in order to identify possible mechanisms of effect.

Parents reported 16 different sleep problems across children, as well as other behaviours possibly indicative of post-traumatic stress response. In total, 34 themes and 26 interactions were extracted in relation to factors identified across participants about the children's sleep and the families' earthquake experiences. This demonstrated how complex it is to explore the development of sleep problems in the context of disaster. Key factors identified by parents that likely played a key role in the development and perpetuation of sleep problems included earthquake related anxiety, parental mental health and conflict, the child's emotional and behavioural problems and other negative life events following the earthquakes. The clinical implications of the analysis included being aware that such families,

may not have had access to specialized support around their children's sleep. This was much needed due to the strain such problems place on the family, especially in a post-disaster community such as Christchurch.

Chapter 1

Introduction

The Christchurch and Kaikoura Earthquakes

On September 4th, 2010 4.35am local time, a magnitude 7.1 earthquake struck near Darfield in the Canterbury region of New Zealand causing extensive damage to Darfield, Christchurch, and the surrounding region. While there was no loss of life, approximately 100 were injured and many more displaced. The earthquake was felt throughout the South Island and parts of the North Island; as far as 900km from the epicentre (Gledhill, Ristau, Reyners, Fry, & Holden, 2011). Christchurch was then subject to a magnitude 6.3 earthquake on February 22nd, 2011 at 12.51pm local time. This resulted in the deaths of 185 people and severe destruction to the city. Both earthquakes triggered thousands of aftershocks, causing additional damage and distress to the city and its inhabitants (Chouw & Hao, 2012). While earthquakes are usually thought of as acute stressors with potentially chronic secondary consequences, the Canterbury region faced an unprecedented scenario with the degree of aftershocks and larger earthquakes which have occurred in this region since the start of the earthquake sequence in 2010. In the two years following the 2010 earthquake, the Canterbury region experienced over 14,000 aftershocks (Liberty, 2017) and on the 22nd November 2016 Kaikoura experienced a magnitude 7.8 earthquake. This earthquake caused extensive damage and created numerous landslides and permanent change to the coastal landscape, temporarily cutting this town off from surrounding regions. It was felt throughout the South Island, and even the bottom of the North Island where the country's capital, Wellington, suffered damage. The ongoing and unpredictable nature of these earthquakes and aftershocks should

therefore be thought of as a chronic series of stressors rather than as acute events due to their ongoing duration and intensity.

While children react to disasters in various ways, a common finding is that adults and children alike will develop sleep problems (Charuvastra & Cloitre, 2009) especially if the individual is suffering from a post-traumatic stress response (Germain, 2013). Data from the *Juniors Settling in and Learning Study* (Liberty, Hooper, & Adams, 2016b) has focused its research on children who were present in Christchurch during the 2010/2011 earthquakes. They have found that rates of sleep problems in children post-earthquake compared to pre-earthquake have increased. These include: trouble going to sleep (11.4% - 28.1%); nightmares (18.8% - 42.1%); waking in the middle of the night (17.8% - 48.5%) and a wet or soiled bed (27.2% - 39%). While fear of sleeping alone was not applicable in the pre-earthquake study, this was at a rate of 36.1% post-earthquakes. In total, the data shows that many more children are experiencing sleep problems post-earthquake compared to pre-earthquake, with 73.1% of children experiencing one or more of these sleep related problems (Liberty et al., 2016b; Liberty, 2017). It is important to find out what may be contributing to these children's sleep problems as good quality sleep is especially important for developing children because it can influence many areas of functioning and development (Zimmerman, 2008). Information gained here may help other families who are struggling with similar problems. To give this thesis, the participants, as well as what other Christchurch families may have gone through some context, the following section will define and provide background information about disasters, as well as highlight some of the immediate and ongoing impacts they may have on children's functioning and development.

The Impact of Natural Disasters around the Globe

Around the world children are exposed to a vast number of disasters or highly stressful events every year. For example, according to the *Annual Disaster Statistical Review 2015* (Guha-Sapir, Hoyois, & Below, 2016), 376 natural disasters were reported worldwide, with a death toll of 22,765 people, and 110.3 million victims. This has decreased from previous years. In 2002-2011, 107,000 people were killed, and 268 million were affected by natural disasters on an annual average (Guha-Sapir, Hoyois, & Below, 2013; Terasaka, Tachibana, Okuyama, & Igarashi, 2015). This demonstrates the sheer magnitude and impact that natural disasters have on people's lives, and these statistics only report on natural disasters, not human-generated disasters or a combination of the two. For example, when taking into consideration the effects of war, millions of children will be exposed to severe stressors through war related events (Alisic, 2011; Ford, Pat-Horenczyk, & Brom, 2009). Additionally, highly stressful events do not need to be so extreme as war or natural disasters. They can include events such as child sexual and physical abuse, maltreatment, or even road traffic accidents. Even when only considering natural disasters, their impact on people's everyday lives is profound. Furthermore, the above statistics do not break down the numbers to show how many children are affected, rather they are included in the general population. Regardless, it is known that children experience high levels of exposure to extremely stressful events (Charuvastra & Cloitre, 2009), and that life is inherently stressful, irrespective of whether the stressor is from disasters or from a natural part of the life cycle, such as the death of a loved one, or chronic disease. It is something no one can avoid, including children (Shaw, 2000). For example, a longitudinal study found that around two-thirds of children experienced at least 1 extremely stressful event by mid-adolescence, with 13.4% of those exposed developing post-traumatic stress (PTS) symptoms (Copeland, Keeler, Angold, & Costello, 2007). In relation to acute reactions to relatively severe stressors, rates of post-

traumatic stress responses may exceed 90% of children and adolescents compared to less severe stressors, where psychopathology rates can fall below 20%, especially if some time has elapsed since the highly stressful event (Pine & Cohen, 2002). Additionally, the lifetime risk of exposure to a potentially traumatic stressor is estimated at 70-90%, with 10% of those exposed developing post-traumatic stress disorder (Shaw, 2000). Clearly, disasters and highly stressful events can have profound, far-reaching consequences for children and adults, and may continue to affect individuals' years after the potentially traumatic event.

Defining Disasters

Disasters can be defined as severe ecological and psychosocial disruptions that greatly overwhelm the coping capacity of the affected community (World Health Organization [WHO], 1992). Their potential to cause excessive destruction of property, as well as the possibility of causing injury or loss of life places disasters outside the realm of "normal" human experience. Accordingly, they are viewed as events which, due to their potential level of impact on individuals, families, and communities, can lead to trauma or stress related reactions regardless of a person's prior functioning (Silverman & La Greca, 2002). As mentioned earlier, disasters can be divided into two broad categories: natural and human-generated. A third category is now recognised which includes a combination of both natural and human-generated disasters. These have been termed complex emergencies or multidimensional disasters (Shaw, Espinel, & Shultz, 2012).

Natural disasters include meteorological disasters such as tropical cyclones, tornadoes, and storms; hydrological disasters such as floods, landslides/mudslides, and avalanches; geophysical disasters such as earthquakes, volcanic eruptions, and tsunamis; climatological disasters such as extreme temperatures, wildfires, and droughts; and biological disasters such as pandemic diseases, crop blights, and diseases of domesticated animals

(Shaw et al., 2012). Human-generated disasters can be further categorized as either nonintentional or intentional. Nonintentional disasters are generally a result of failure of technology and include industrial accidents, transportation accidents, and ecological/environmental destruction, whereas intentional disasters encompass war, terrorism, civil strife, ethnic conflict, and violent mass gatherings and demonstrations (Shaw et al., 2012). Multidimensional disasters include extensive violence, loss of life, displacement, societal and economic disruption, and the need for large-scale humanitarian assistance. For example, the 2011 9.0 magnitude earthquake in Japan generated a tsunami which rose above the seawalls protecting several nuclear power plants. This resulted in damage of the cooling systems and then partial meltdown and radiation release over populated areas (Shaw et al., 2012). This shows how devastating the combination of natural, and human-generated nonintentional disasters can be.

Stressors Following a Disaster

What all disasters have in common is their potential to create an array of stressors. These include threat to one's own life and physical integrity, bereavement, profound loss, exposure to the dead and dying, social and community disruptions and ongoing hardship (Norris, et al., 2002). Stressors associated with disasters can be defined as either primary or secondary stressors. Primary stressors are associated with direct exposure to harm during the actual event, and are related to acute threats to well-being, physical integrity, and one's own life. These occur as a result of the acute stressor, for example, the ground-shaking of an earthquake which can be circumscribed in space and time. Secondary stressors occur as a result of the primary stressor and include the consequences and adversities experienced in the aftermath of disaster. For example, in the aftermath of an earthquake, individuals may face a cascading series of secondary stressors which could include loss of possessions and home, displacement, school closure or loss, unemployment, loss of power and water, and friends

moving away. These stressors can last for weeks, months, or even years and may challenge children's and families' ability to adapt and cope with their situation (Shaw et al., 2012; Silverman & La Greca, 2002). Unlike acute stressors, chronic stressors are characterized by ongoing exposure to continuous, unrelenting adversities such as war; or to episodic repetitive exposures such as sporadic terrorist attacks (Shaw et al., 2012). Chronic stressors are particularly dangerous in regard to future outcomes and responses to stressful events as they may result in the steady loss of resilience and adaptive coping skills (Shaw et al., 2012). This relates to the concept of cumulative risk. Here, there is a dose-response effect where increased exposure to extremely stressful events does not increase resilience or make one stronger, but instead makes the child more vulnerable to psychological morbidity and increases risk for problems such as central nervous system change, anxiety, depression, dissociative reactions, suicidal thoughts, personality changes, substance abuse, loss and grief reactions, decreased social function and aggressive and delinquent behaviours (Shaw et al., 2012).

Children's Reactions to Disasters

Prior to the 1970s children were often overlooked in disaster research as it was believed that children's reactions to disaster and stressful events would be mild, and that disasters would only cause short-lived adjustment reactions and transient distress (Alisic, 2011; L. Davis & Siegel, 2000; Vogel & Vernberg, 1993). It is now recognised and accepted that children, like adults, may have post-disaster reactions that cause significant impairment in their functioning and distress in their daily lives, both short-term and long-term (Alisic, 2011; Silverman & La Greca, 2002). Children's reactions to disaster may be influenced by numerous factors such as age (Davis & Siegel, 2000; Dogan-Ates, 2010; Vogel & Vernberg, 1993), the nature of the stressor, the child's level of cognitive development, personality

characteristics, theories of causality, their adaptive coping mechanisms and reactions of family members (Shaw et al., 2012).

Potential Reactions of School-Aged Children to Disasters. Children do not react uniformly to highly stressful events. Rather, they display a range of variable responses that are not necessarily included in symptoms related to trauma diagnoses such as acute stress disorder (ASD) or post-traumatic stress disorder (PTSD) (American Psychiatric Association, 2013). Furthermore, children may be unable to be neatly classified as having either ASD or PTSD. It is more likely that they fit somewhere in the middle, that is, having symptoms more severe than typical ASD but still under the clinical threshold for PTSD. Children's reactions may encompass somatic, cognitive, emotional, and behavioural, domains. Somatic reactions may include loss of energy, physical complaints such as headaches or stomach-aches, and appetite disturbances, while behavioural reactions may include aggression, problems in peer relations, and social and emotional withdrawal (Dogan-Ates, 2010; Shaw et al., 2012). Cognitive reactions encompass a diverse range of responses including vulnerability to anniversary reactions, poor concentration and school performance, distractibility, distortions about causes of the disaster, and believing in supernatural forces (Dogan-Ates, 2010). Finally, an extensive range of emotional reactions include moodiness, anger, denial, worry, guilt, sadness, self-blame, tearfulness, helplessness, depression, anxiety, trauma related fears, and generalized fears (Dogan-Ates, 2010; Shaw et al., 2012). In response to disasters, children exhibit elevated levels of fears as well as a wide range of problems and may become inconsistent in their behaviours (Dogan-Ates, 2010).

Acute Stress Disorder. Acute stress reactions are typical after a disaster or highly stressful experience (Silverman & La Greca, 2002). Immediate reactions may include a state of shock as well as a series of physiological symptoms referred to by Selye as the General

Adaptation Syndrome (as cited in Silverman & La Greca, 2002). This involves increased levels of cortisone and adrenaline, as well as suppression of immune functioning (Silverman & La Greca, 2002). Upon initial exposure to a severe stressor, the body enters into a state of physiological hyperarousal commonly described as the fight, flight, or freeze response (Shaw et al., 2012). This is an adaptive response where the goal is to preserve the life of the individual (Kendall-Tackett, 2000). Common acute physical symptoms may include pounding heart, trembling, sweating, shortness of breath, nausea, dizziness and difficulty concentrating. This response is an attempt to restore the individual to a more optimal level of functioning (Shaw et al., 2012). Normal stress responses after the disaster or stressful event are characterized by anxiety, fear, feelings of helplessness, grief and mourning in response to losses, mood and anxiety symptoms associated with separation from loved ones, behavioural problems and somatic illness (Shaw et al., 2012).

Acute stress symptoms generally resolve naturally over time as normal functioning is restored (Silverman & La Greca, 2002). However, the natural stress response may become maladaptive in cases where the stressor is either an extreme one-time event which overwhelms the system with stress hormones, or if it is a chronic, ongoing stressor in which the acute stress response becomes a frequent occurrence (Kendall-Tackett, 2000). Here, the child may struggle to adapt to the circumstances and their psychological response may become severe enough to meet criteria for a trauma-related disorder. In this case, an acute stress reaction may develop into acute stress disorder. Onset must be within one month of exposure to trauma, with a duration of approximately two days and no longer than four weeks. It typically resolves naturally with time (American Psychiatric Association, 2013; Silverman & La Greca, 2002).

Post-traumatic Stress Disorder. Post-traumatic stress disorder occurs when the psychological response is severe enough that ASD does not naturally resolve, and instead

develops in to PTSD (Silverman & La Greca, 2002). However, this is the most extreme reaction and as stated above, children may fall somewhere in between ASD and PTSD. Like ASD, the onset must be caused by exposure to a severe stressor or event, a unique distinction compared to most other psychiatric disorders which do not require an initiating stressor (Copeland et al., 2007; Zoellner, Bedard-Gilligan, Jun, Marks, & Garcia, 2013). PTSD can also result from learning about a highly stressful event involving threatened death or injury to a close family member or friend. In children under six years of age, this refers to the parent or caregiver (American Psychiatric Association, 2013; Zoellner et al., 2013). Children can develop PTSD from as early as one year of age. Symptoms usually begin within the first three months after the highly stressful or traumatic event, however, there may be a delay. This is referred to as late-onset PTSD (American Psychiatric Association, 2013; Silverman & La Greca, 2002). While the long-term course is not as clear, it is evident that PTSD can persist many years after the highly stressful experience (Shaw et al., 2012), although symptoms tend to decrease rapidly during the first year after disaster (Furr, Comer, Edmunds, & Kendall, 2010; Terasaka et al., 2015; Vogel & Vernberg, 1993).

PTSD is characterized by four main clusters of symptoms These include intrusive reexperiencing, persistent avoidance, negative alterations in mood and cognitions, and hyperarousal (American Psychiatric Association, 2013). This has changed since the DSM-IV which does not acknowledge change in mood and cognitions associated with the traumatic event (Zoellner et al., 2013). Reexperiencing can involve intrusive memories, thoughts, and dreams relating to the extremely stressful event; dissociative reactions such as flashbacks, where the individual feels or acts like the stressful event is recurring; intense psychological distress and/or marked physiological reactions in response to exposure to external or internal cues related to the traumatic event (American Psychiatric Association, 2013). Children under six may display slightly different, but related symptomatology. For example, re-experiencing

may be expressed as engagement in repetitive play with themes relating to the traumatic event; frightening dreams without specific, recognizable context; and trauma-specific re-enactment (American Psychiatric Association, 2013; Shaw, 2000; Vogel & Vernberg, 1993).

The avoidance cluster of symptoms refers to attempts to avoid stimuli associated with the traumatic event. This includes distressing thoughts, feelings, memories, or external reminders such as conversations, activities, objects, or situations related to the traumatic event (American Psychiatric Association, 2013). The DSM-IV included numbing symptoms within avoidance, however the majority of findings suggest having these two symptom clusters together is inappropriate as it is generally agreed that avoidance and numbing symptoms are structurally distinct phenomena. While they may serve similar escape functions, they may also occur due to different mechanisms. For example, avoidance is used to strategically avoid traumatic reminders while numbing may occur due to automatic responses in arousal (Zoellner et al, 2013). In response to this evidence, the DSM-5 includes an avoidance cluster as stated above and reconceptualises the numbing factors under the negative alterations in cognitions and mood cluster (Zoellner et al., 2013). This includes negative cognitions, beliefs, and expectations; distorted blame; persistent negative emotions and inability to experience positive emotions; feelings of detachment and estrangement; diminished interest or participation in significant activities; and inability to remember important aspects of the highly stressful event (American Psychiatric Association, 2013).

The final PTSD cluster is hyperarousal whereby there are marked changes in arousal and reactivity. This can include irritable behaviour and angry outbursts, recklessness or self-destructiveness, hypervigilance, an exaggerated startle response, problems with concentration, and sleep disturbance (Alisic, 2011; American Psychiatric Association, 2013). While there are strict diagnostic criteria for PTSD, PTS symptoms in general can vary greatly

between children depending on numerous child and disaster related characteristics (Furr et al., 2010).

Factors which Influence Children's Reactions to Disaster

There are several factors that may influence the severity of children's post-disaster response. These include characteristics relating to the disaster itself, disaster exposure and duration of exposure, as well as individual characteristics of the child, and the social environment in which the disaster is embedded (Furr et al., 2010; Pine & Cohen, 2002; Vogel & Vernberg, 1993).

In relation to aspects of the disaster and disaster exposure, objective elements such as a child's physical proximity to a disaster can influence the severity of post-traumatic stress (PTS) symptoms (Furr et al., 2010). Proximity is often used as a proxy of exposure to the extreme stressor, although it cannot provide information about perceived life threat or whether grotesque scenes of destruction were possibly witnessed (Furr et al., 2010; Vogel & Vernberg, 1993). This relates to the child's subjective experience of the disaster which may be more important than physical proximity in determining children's post-disaster reactions (Silverman & La Greca, 2002). This is because children must be aware of what is happening and that they are in fact in danger in order to develop traumatic stress reactions. Accordingly, perceived life threat and general distress at the time of disaster are two key aspects which predict children's PTS reactions (Furr et al., 2010). Loss of a loved one, injury to self or a loved one, major damage, and separation from parents are other factors relating to the disaster that influence children's reactions (Furr et al., 2010; Sadeh, 1996; Vogel & Vernberg, 1993).

Of particular relevance to the Christchurch earthquakes is the duration of exposure. The first earthquake on September 4th 2010 triggered a relatively standard aftershock sequence. This evolved into a complex, long-lasting series of earthquakes through to 2012

(Bannister & Gledhill, 2012). While there have been continuing earthquakes in the years following, the period between 2010 and 2012 was of peak intensity with approximately 14,000 earthquakes (Liberty, 2017). Typically, an earthquake would be thought of as a Type I trauma, as the event is limited in time and space. This is not the case for Canterbury. It is the unrelenting duration of exposure in not only those peak years but with continuing earthquakes in the 7 years following that makes the Canterbury earthquakes a Type II trauma. With Type II trauma the child may manifest a range of developmental, emotional, and behavioural problems associated with chronic stress alongside post-traumatic stress symptomology (Shaw, 2000). Such trauma may be evident in some children in Christchurch as stress-related health issues including sleeping problems, stomach-aches, headaches, and changes in eating/eating problems have increased (Liberty et al., 2016b) while teacher-reported behaviour problems in young children have more than doubled post-earthquakes (Liberty, Tarren-Sweeney, Macfarlane, Basu, & Reid, 2016a). A number of child characteristics have also been explored in relation to children's reactions to disaster. Gender is a factor which has been studied copiously yet has produced many contrary results. For example, while studies tend to find that girls have greater PTS symptoms compared with boys, some studies have found no differences while others have found that boys are more affected. However, it may be that gender differences emerge later in adolescence considering that differences in internalizing symptoms emerge at puberty (Furr et al., 2010). Individual personality traits have also been studied to some extent, and it has been suggested that children who are naturally shy, apprehensive, and/or overly imaginative with a tendency to overinterpret danger may be more likely to develop negative psychological outcomes after being exposed to disasters or highly stressful events (Shaw, 2000). Finally, a child's mental health at the time of the disaster or stressful life event can impact functioning. For older children and adolescents, a common finding is that pre-existing anxiety and depression

significantly predict post-disaster PTSD (Furr et al., 2010). Additionally, previous exposure to stressful events can also increase the risk for negative post-disaster functioning. This cumulative risk means that children become more likely to experience PTS symptomatology with increased exposure to highly stressful events (Kovachy et al., 2013; Shaw, 2000). However, PTS symptoms and risk factors must be assessed with caution in younger children, especially with pre-verbal children, as these may be more difficult to identify in this age group. (Scheeringa, Zeanah, Myers, & Putnam, 2003).

Developmental Considerations of Children's Reactions to Disaster

Children are particularly vulnerable following disasters or highly stressful events due to their lack of experience in coping with such events, and because of a lack of skills and resources to meet their own mental and behavioural needs (Shaw et al., 2012). They are dependent on the adults in their lives to recognise they may need help, and then to provide this help. However, children's needs may be inadvertently neglected as those most likely to realise the child is struggling, (e.g. parents and teachers), may be dealing with their own post-disaster reactions and so the child's psychological and emotional needs may be being overlooked (Silverman & La Greca, 2002). In a review study by Norris et al (2002), it was found that school-age children were more vulnerable to the effects of disaster compared to adults. For example, 52% of children compared to 42% of adults experienced severe to very severe effects post-disaster. Furthermore, children are heavily influenced by their own parent's psychological functioning post-disaster as they rely on their parents to determine their own degree of safety. For example, following an Australian bushfire, important influencing factors for children's PTS symptomatology included maternal preoccupation with the disaster, as well as changed family functioning and separation from parents in the immediate aftermath of the fire (McFarlane, 1987; Shaw, 2000). Clearly the parents and family context play an important role in children's post-disaster reactions.

Age is a factor that has been examined in depth within the literature in order to see how children of different ages are affected, and how they may try to cope with disasters and highly stressful events. Age is also particularity important because it can be used as an index of developmental skills. It also reflects differences in children's capacity to understand the nature of stressful events as well as their own involvement (Dogan-Ates, 2010; Vogel & Vernberg, 1993). It has been found that school-aged children tend to exhibit more overall psychological distress compared to pre-schoolers, but less than adolescents (Dogan-Ates, 2010). Such differences may be because very young children have less cognitive awareness of the nature and meaning of a disaster or highly stressful event, whereas school-aged children are more cognitively mature and so can better understand the nature of the event as well as its potential to possibly inflict injury or death (Dogan-Ates, 2010). Following a potentially traumatic event, pre-school aged children tend to react in a more disorganised and agitated way compared with older children. They display generalized fears, separation anxiety, aggressive and disruptive behaviours, and somatic symptoms and regression. School-aged children may experience sleep and appetite disturbance, school based academic and behavioural problems, externalizing and disruptive symptoms, depression and anxiety, somatic problems, and PTSD symptoms (Dogan-Ates, 2010).

Children's cognitive development is tied to their age and heavily influences their reactions to disasters and highly stressful events. Egocentric theories of causality can influence the child's understanding, interpretation, and psychological response (Shaw et al., 2012). For example, younger children do not understand chance happenings. They may therefore believe that the disaster or stressful event is directly related to something they have done and is a punishment. Terr (1981; as cited in Shaw, 2000) described this as "omen" formation. In comparison, older children tend to have a better understanding of such events. Younger children also have a skewed sense of time. This means that they can have trouble

putting events in chronological order and are therefore vulnerable to illusory and cognitive distortions. As they recount the event, younger children may therefore embellish and fill in any gaps according to their own fears or wishes (Shaw et al., 2012). Clearly, children's age and developmental level have a fundamental impact on how they interpret and react to disasters and highly stressful events.

The Biological Impact of Stress and Trauma on Children

Trauma and chronic levels of stress are particularly detrimental to children as it can interfere with typical development. More so if this occurs during developmentally sensitive periods such as very early childhood or adolescence (De Bellis & Zisk, 2014). This means that children are especially vulnerable to the impact of disasters and potentially traumatic events as the impact of these events will be compounded with the influence they have on their continuing development, as it has been demonstrated that trauma during childhood is associated with adverse brain development, with negative impacts on multiple areas such as emotional and behavioural regulation, some of these changes being permanent (De Bellis & Zisk, 2014). For example, chronic stress may cause permanent changes in biological stress response systems. This can be seen in children after trauma who show elevated cortisol levels. This may be a result of sensitization of certain stress systems such as the limbic-hypothalamic-pituitary-adrenal (LHPA) axis, meaning individuals will 'hyper'-respond in the face of acute stress or traumatic reminders. This may then trigger an adaptive change where the corticotrophin releasing hormone (CRH) receptors are down-regulated in order to minimize physical harm or illness caused by elevated CRH which plays a key role in mediating the stress response (De Bellis & Zisk, 2014). This is in accord with the theory of allostatic load proposed by McEwan (2007), hypothesising that organisms adapt to re-regulate psychobiological responses to chronic stress in order to prevent harm. However, increasing allostatic load over the lifespan increases vulnerability to stress disorders, such as

PTSD, in response to new stressors (McEwen, 2007). This falls in line with the concept of cumulative risk mentioned previously (Shaw et al., 2012).

Elevated levels of stress hormones during brain maturation leads to dysregulation of a child's major stress systems. This is likely to contribute to adverse brain development and psychopathology through numerous processes (De Bellis, 2001), for example, delays in myelination, abnormalities in neural pruning, and stress induced decreases in brain growth (De Bellis, 2001; De Bellis & Zisk, 2014; Pizarro et al., 2004). Such disruptions can vary due to individual gene x environment interactions, thereby impacting both negative and resilient outcomes. Evidence suggests there are certain risk genes which interact with childhood trauma to produce various adult emotional, behavioural, and neurobiological outcomes (De Bellis & Zisk, 2014).

There are numerous biological systems impacted by early trauma and chronic levels of stress. Two key systems include the sympathetic nervous system (SNS), and the serotonin system (De Bellis & Zisk, 2014). The SNS plays a fundamental role in the stress response and encompasses the "fight, flight or freeze" response which plays a central part in ensuring survival in the face of a threat. Higher activity in the SNS is associated with symptoms of PTSD and anxiety, while down-regulation in response to trauma may be associated with dissociation and anti-social behaviour in both children and adults (De Bellis, 2001; De Bellis & Zisk, 2014). The serotonin system also has a critical part in regulating the stress response, as well as playing known roles in regulating emotions, behaviours, cognitive function, motor function, appetite, as well as many physiological processes (De Bellis & Zisk, 2014; Lucki, 1998; Siever, 2008). Serotonin is important for early brain development and disruptions in this system as a result of trauma are linked to several psychopathological disorders such as anxiety and depression (De Bellis & Zisk, 2014; Ressler & Nemeroff, 2000). This demonstrates that the biological consequences caused by disruptions in brain development

due to stress and trauma have a sequalae of outcomes in regard to the short and long-term impacts on children, especially during sensitive periods of development such as early childhood or adolescence where the brain undergoes extensive natural developmental changes.

This section has extensively covered the impacts disasters can have on children, including what may influence children's reactions to disasters. The following section will involve a literature review which will extend from the previous section, including the prevalence rates of PTSD following disasters, and the impact of disasters and stress on sleep.

Chapter 2

Literature Review

Before delving into the ways in which sleep may be impacted in children following a natural disaster, the role of PTSD in children following disasters is first addressed. The reason for this was due to the nature of sleep in the disaster literature. Specifically, as a result of the complex and near inseparable relationship between sleep and PTSD, there is little literature which addresses sleep without relation to PTSD in the context of disasters. It therefore made sense to first consider PTSD within the disaster literature because this is the predominant focus of disaster literature. This is followed by sleep problems in the context of natural disaster. Then PTSD and sleep are brought together, and the reciprocal nature of their relationship is addressed. Lastly, other factors which influence the development of sleep problems, as well as an ecological perspective on disaster is addressed.

Prevalence of Post-Traumatic Stress Disorder after Natural Disasters in Mixed Samples

Post-traumatic stress disorder is the most commonly studied psychopathology in relation to disasters or highly stressful events. It is also likely one of the most frequent and debilitating psychological disorders experienced among the general population, including children and adolescents, following a traumatic experience (Breslau, Chase, & Anthony, 2002; Galea, Nandi, & Vlahov, 2005; Neria, Nandi, & Galea, 2008; Norris et al., 2002; Trickey, Siddaway, Meiser-Stedman, Serpell, & Field, 2012; Zhang, Zhu, Du, & Zhang, 2015b). A meta-analysis by Dai et al. (2016) examined the incidence rate of post-traumatic stress in a mixed sample of child, adolescent and adult survivors after earthquakes. This study included 46 articles from 1999-2013 describing the prevalence of PTSD in survivors of magnitude 4.0-9.0 earthquakes. Results indicated that out of the combined 76,101

participants, 17,706 were diagnosed with PTSD, nearly one quarter of survivors. The PTSD prevalence rate ranged from 1.20% to 82.64% across studies. The combined incidence of PTSD was 23.66%, with 28.76% diagnosed within the first 9 months post-disaster and 16.48% diagnosed after 9 months.

While Dai and colleagues suggest their findings could reflect the actual incidence rates of PTSD after earthquakes worldwide, 40 out of the 46 studies used self-report measures as the sole method of data collection. This may therefore be an overestimate. Furthermore, there was also a high degree of heterogeneity between studies which could not be explained, indicating that there may be some uncertainty around the combined incident rate. However, the high incidence rate may be partially explained by the nature of earthquakes. Unlike other natural disasters such as hurricanes and floods, there is no warning (Shaw et al., 2012). Earthquakes have a sudden and unpredictable onset, and possibly, a greater level of destruction compared to other disasters (Gökçen, Şahingöz, & Annagür, 2013). This causes higher levels of damage to property as well as a greater impact on physical and mental health. This may therefore lead to higher incidence rates of PTSD compared to other natural disasters (Dai et al., 2016). For example, a similar meta-analysis by Chen and Liu (2015) examined incidence rates of PTSD in flood victims. Results indicated the incident rate of PTSD was much lower compared to earthquake victims. Out of 40,600 flood victims, 3862, were diagnosed with PTSD, approximately one-tenth of the sample, reflecting as incidence rate of 15.74%.

While the above meta-analysis by Dai et al. (2016) included studies with child and adolescent participants, the impact of age specific effects could not be analysed as most studies did not report ages. This is unfortunate as it is known that the effects of disaster and experience of PTSD and trauma-related symptomology vary according to age, and emotional and cognitive development (Alisic, 2011; Dogan-Ates, 2010). However, Wang, Chan, and Ho

(2013) completed a systematic review looking at the prevalence and trajectory of psychopathology, including PTSD, in children and adolescent disaster survivors across epidemiological studies from 1987-2011. Studies regarding natural disasters included 35 following earthquakes, 11 following tsunamis, 15 following hurricanes, 7 following tornadoes, cyclones and typhoons, 5 following floods, 6 following fire disasters, and 1 following a volcanic eruption. Overall, PTSD estimates ranged from 2.5-95% in studies following earthquakes, 6.0-70.7% following tsunamis, 1.0-90% following hurricanes and tornados, 9.0-36.7% following fire disasters, and 2.05-37% following floods.

Variation of Post-Traumatic Stress Disorder

Results must be interpreted with caution as one reason for the large variance in the prevalence of PTSD across studies is due to the change in PTSD diagnostic criteria over the last 40 years (Galea et al., 2005; Wang, Chan, & Ho, 2013). For example, when Wang and colleagues removed studies which used convenient or high-risk samples, or which used measurement techniques that did not meet DSM-IV criteria PTSD rates according to the DSM-IV criteria in studies showed some fluctuation. Specifically, PTSD estimates changed to the following: 2.5-60% following earthquakes, 10.4-57.3% following tsunamis, 1.0-55.3% following hurricanes, cyclones and typhoons, and 2.05-32% following floods (Wang et al., 2013). This shows the discrepancy and variation among studies when different methodologies are employed and effectively demonstrates a key difficulty in comparing results across disaster studies, both in child and adult samples. Variation of PTSD rates across studies is common in the disaster literature. For example, Dai et al. (2016) reported a range from 1.20% to 82.64%. Likewise, Galea, Nandi and Vlahov (2005) reported prevalence rates ranging from 5-60% across 86 natural disaster studies while Neria, Nandi and Galea (2007) reported prevalence rates ranging from 3.7-60% across 116 natural disaster studies.

The Longitudinal Course of Post-Traumatic Stress Disorder

There is limited longitudinal research on PTSD following disasters, in both the child and adult literature. For example, in the meta-analysis by Dai et al. (2016), only 6 of the 46 studies were classified as longitudinal, with follow up times ranging from 2-5 years. Wang et al. (2013) also attempted to examine the trajectory of psychopathology, including PTSD, in children and adolescent survivors of disasters. This included 25 longitudinal and long-term follow up studies ranging between 1-20 years. However, approximately one-third of studies completed final interviews within 1-year post-disaster. Results indicated that rates of PTSD symptoms tended to decline with time, and overall peak effects of disaster were observable at the one-year mark post-disaster, which is in line with previous findings (Furr et al., 2010; Vogel & Vernberg, 1993). However, research on the long-term trajectory of PTSD in relation to disasters is underdeveloped as the majority of studies tend to focus on the first 2 years post-disaster. As a result, Terasaka, et al. (2015) examined longitudinal studies with a minimum 3-year follow up. This resulted in only ten studies published between 1980 and early 2014. Similar to Wang et al. (2013), and Furr et al. (2010), they also found that symptoms tended to decline in the 1-2 year mark post-disaster.

However, not all studies follow this trajectory. Jia et al. (2013), found that PTSD symptoms persisted over the 3 years following the Shichuan earthquake in China. No significant differences were found in symptoms in a sample of 596 children aged 8-18 years, with prevalence rates only dropping from 12.4% 15 months post-disaster to 10.7% 3-years post-disaster. This was attributed to a possible delayed impact on those not directly affected by the earthquake. While delayed impacts following disaster do occur, they tend to be rarer (Silverman & La Greca, 2002). However, persistence of symptoms could also have been related to secondary stressors and adversities as well as higher exposure and levels of loss as a result of the earthquake (Jia et al., 2013).

Similarly, Piyasil et al. (2007) assessed 1,364 students in two schools in the Phang Nga Province, the most severely affected area following the tsunami disaster in Thailand in 2004. At 1-year post-disaster, 86 out of the 272 victims (31.6%) met criteria for PTSD according to the DSM-IV. 3 years post-disaster 45 of the 86 children were available for follow up. Of these 45 only 25% had completely recovered while 11.1% reported chronic PTSD and nearly 50% were in partial remission or had subsyndrome PTSD. The authors concluded that while there had been a decrease in symptomology, a significant number of students still suffered from post-traumatic stress symptoms (Ularntinon et al., 2008). Again, high prevalence rates could be attributed to the severity of the disaster as well as the sample which could be considered high-risk as they were in the most severely affected area. A particular strength of this study is that they record the number of children who fall short according to the clinical cut-off, but who will still be experiencing distress due to their symptoms, something that can be overlooked in the disaster research. While Wang et al. (2013) did examine trajectory patterns of PTSD, two thirds of their studies did not have follow up periods greater than 2 years. Again, the difference in methodology in longitudinal research, including the period of assessment as well as the inconsistency of what is considered longitudinal make it difficult to compare long-term outcomes post-disaster.

Common Limitations in Disaster Research

While the change in diagnostic criteria, explained above, reflects one reason for the variation in PTSD prevalence rates across literature, this can also be attributed to methodological factors such as time of PTSD assessment, differences in instrument and cut-off points, variance in specific adult, child and adolescent risk factors as well as the scope of the disaster and the nature of the sample population. For example, in Wang et al's. (2013) study, of the 85 disaster studies reviewed, over 30 different measures were used to assess PTSD symptoms. Different thresholds were also used across studies, including with the same

instrument. Additionally, less than 40 of the 85 studies used clinical interviews based on DSM criteria, which gives the most accurate prevalence rates of true PTSD.

Careful attention must also be paid to not only the variation in sample size, but their location in terms of the disaster. For example, in natural disaster studies samples tend to recruit from a broad range of people within the community, therefore likely getting mixed sample of individuals who could be considered either direct victims, i.e. those more severely affected than others in the population, as well as indirect victims, i.e. those less effected (Galea et al., 2005; Neria et al., 2008). This is demonstrated by Armenian et al. (2000) who examined rates of PTSD among 1785 adult survivors of the 1988 Armenian earthquake. They found that PTSD cases included more individuals from areas with the worst destruction and that PTSD increased according to the level of loss experienced by the family. Similarly, in children exposed to the same disaster, 95% of the children from a severely exposed city and 26% from a mildly exposed city had severe PTSD symptoms 1.5 years post-earthquake (Goenjian et al., 1995; Neria et al., 2008). Basoglu, Kilic, Salciogllu and Livanou (2004) also found that rates of PTSD were higher in two samples around the Marama earthquake epicentre (23%; n = 530) compared to 100km away (14%; n = 420) in individuals over 14 years of age. This is not surprising as proximity to the epicentre of an earthquake can be used as an approximation of level of exposure. This is a risk factor which has been associated with the severity of PTSD and post-disaster outcomes in disaster studies relating to children and adolescents (Furr et al., 2010; Vogel & Vernberg, 1993).

There also tends to be a lack of control comparisons and the majority of studies are cross-sectional by design. Therefore, results may not be representative of the whole population meaning caution must be taken in regard to generalizability (Wang et al., 2013). It is also important to note there also tends to be a lack of pre-disaster information regarding PTSD symptomology in the affected population, which is inherent in disaster literature due

its nature. Galea et al (2005) has therefore suggested that “prevalence” rates are better thought of as “incidence” rates because this reflects the rate of PTSD at the time while acknowledging that some individuals may have been symptomatic prior to the disaster and their symptoms may therefore reflect the impact of cumulative risk and prior trauma (Shaw et al., 2012).

Prevalence of Sleep Problems in a Post-Disaster Context

There is no doubt that sleep problems are a common occurrence, in both children and adults, in a post-disaster context (De Young, Kenardy, & Cobham, 2011; Dogan-Ates, 2010; Norris et al., 2002; Shaw et al., 2012; Vogel & Vernberg, 1993), supporting the proposition by Sadeh (1996), that the sleep-wake system is one of the most vulnerable regulatory systems when exposed to highly stressful and potentially traumatic events. As addressed previously, common limitation of disaster research as a whole is that there is often no pre-disaster data in which to compare against as a reliable control. Dirkzwager, Kerssens and Yzermans (2006) managed to circumvent this problem with the use of electronic medical records. Dirzwager and colleagues examined health problems which included sleep problems after the Enschede Netherlands fireworks disaster in a longitudinal study from 1-year pre-disaster to 2-years post-disaster. The sample consisted of 752 children, aged 4-12 years and 535 adolescents, aged 13-18 years with control groups of 1,371 and 918 respectively. The authors found that sleep problems significantly increased in both children and adolescents compared to controls. For example, for every 1000 children pre-disaster 4 victims and 8 controls reported sleep problems compared to 1-year post-disaster where 23 victims and 3 controls reported sleep problems at 2 years post-disaster rates of sleeping problems dropped to 13 victims and 2 controls for every 1000 children. For every 1000 adolescent pre-disaster, 16 victims and 1 control reported sleep problems compared to 1-year post-disaster where 34 victims and 9 controls reported sleep problems. At 2 years post-disaster this dropped to 12 victims and 6

controls for every 1000 adolescents. This demonstrates that sleeping problems increased at a greater rate in those that were impacted by the disaster. For younger children in particular, the sleep-wake system was particularly vulnerable as children presented with larger increases in sleep problems whereas adolescents demonstrated larger increases in anxiety compared to controls (Dirkzwager, Kerssens, & Yzermans, 2006).

Sleep problems have also been reported following natural disasters. Zhang, Zhang, Zhu, Du and Zhang (2015b) explored somatic symptoms in a sample of 3053 children and adolescents, ranging from 8 to 19 years, 3 months after the Lushan earthquake in China. The most frequent somatic symptoms included trouble sleeping, endorsed by 83.2% of the sample and feeling tired or having low energy, endorsed by 74.4% of the sample. In a 6-month longitudinal follow up of the same study Zhang, Zhu, Du and Zhang (2015a) reassessed 2,299 of the original 3053 participants. Due to the slight attrition of the sample, prevalence rates of trouble sleeping and feeling tired or having low energy were reported as less at 3 months compared to the original study, although they were still among the top two most frequent symptoms. At 3 and 6 months respectively, trouble sleeping was endorsed by 58.4% and 48.4%, followed by feeling tired or having low energy which was endorsed by 52.0% and 46.1% of the sample. Additionally, while a high proportion of the sample still endorsed trouble sleeping at 6 months, it did show a significant decrease, possibly indicating a gradual or spontaneous improvement in sleep after the earthquake (Zhang et al., 2015b). While no explanation was given regarding attrition, it is possible that those that dropped out were suffering from more severe post-disaster responses. For example, in a similar study, those who dropped out at 20-months post-disaster tended to have more severe post-disaster reactions at 8-months post-disaster compared to those who did not drop out (Iwadare et al., 2014).

Similarly, following the Wenchuan earthquake in China, 38% of an adolescent sample of 1,573 participants reported sleep disturbance at 1-year post-disaster which only dropped to 37.5% at 2-years (Fan, Zhou, & Liu, 2017). Difficulty sleeping was also one of the most commonly reported symptoms after an earthquake in Los Angeles in younger children in 117 families with a child aged 4-8 years (Proctor et al., 2007). The authors found that 71% of children endorsed difficulty sleeping at 1-month post-disaster which dropped to 39% 8 months post-disaster. In comparison, Gokcen, Sahingoz and Annagur (2013) examined the impact of a non-destructive, moderate sized earthquake in Turkey in a sample of 450 children aged between 12 and 14 years recruited from schools at the epicentre. They found that 13.4% reported sleep disturbance as a frequent problem at 6 months post-disaster. Lower rates of sleep problems are likely related to the magnitude of the disaster as well as the use of different methodological techniques between studies.

In addition, variance of sleeping problems could be attributed to the timing of assessment and the sample demographics, i.e. if one of convenience, meaning participants were highly exposed and therefore a high-risk group (Zhang et al., 2015a, 2015b). Additionally, developmental factors should be considered. For example, Proctor et al.'s (2007) study consisted of younger children who may be more vulnerable to experiencing sleep problems as children have been found to experience sleep problems at a higher rate compared to adolescents' post-disaster (Dirkzwager et al., 2006).

While the above studies have been largely earthquake related, this is most likely because this is the most common natural disaster and so are over-represented in the literature (Gökçen et al., 2013). However, sleep related problems have been studied in reference to other natural disasters as well. For example, Brown, Mellan, Alfano and Weems (2011) examined sleep disturbance and fear of sleeping alone after Hurricane Katrina in 191 children and adolescents aged 8-15. They found that at 24 months sleep disturbance and fear of

sleeping alone were prevalent in 46% and 25% of the sample respectively. Interestingly, at 30 months, general sleep disturbance had increased slightly to 50% while fear of sleeping alone decreased to 16%.

Specific Changes in Sleep Post-disaster

One of the limitations of the above research is that as there is a general lack of consistency on what actually defines a sleep problem. So, while the above articles commonly refer to "sleep problems", "trouble sleeping" or "sleep disturbance", this could encompass a range of varying issue, for example, delayed sleep onset, nightmares or night waking (Leahy & Gradisar, 2012). In addition, sleep problems are essentially a subjective issue and may vary between cultures. This is because what is defined as problematic by one parent may be regarded as within the realms of normalcy for another (Davis, Parker, & Montgomery, 2004; Sadeh, Mindell, & Rivera, 2011).

A few studies have looked at specific influences on sleep in light of a natural disaster as well as how specific factors of the disaster may relate to sleep problems. Geng, Fan, Mo, Simandl and Liu (2013) examined sleep problems among 1,573 adolescent survivors in a cohort study following the Wenchuan earthquake in China. Participants were in the 7th (approximately 12-13 years of age) and 10th grades (approximately 15-16 years of age), 21km from the epicentre. Sleep duration, sleep onset, night-waking, sleep quality and daytime functioning were evaluated for 2.5 years at 12, 18, 24, and 30 months post-disaster. At 12 months (n = 1,398) 48.90% reported less than 7 hours of sleep per night, 27.68% reported difficulty initiating sleep, 8.82% reported night-waking, 22.60% reported poor sleep quality and 40.01% reported difficulty with daytime functioning. Changes in sleep duration and sleep onset have also been found in other studies across children and young adolescents

following the Japan boxing day earthquake and tsunami (Iwadare et al., 2014; Usami et al., 2013).

Geng et al. (2013) also found that the sleep problems were stable across the 18-30 months with prevalence rates between 28.79 - 30.18% according to the Pittsburgh Quality Sleep Index (PSQI). They were also noticeably higher (>10%) compared with other adolescent studies in China using the same measurement (Liu, Uchiyama, Okawa, & Kurita, 2000; Xu et al., 2012). Although there was a gradual decline in participants experiencing difficulty initiating sleep (27.68 – 17.42%) across 12-30 months post-disaster which Geng and colleagues thought could indicate gradual emotional recovery. Overall the stability of sleep problems across 30 months shows how persistent sleep problems may be following a natural disaster.

The Effects of Specific Disaster Experiences on Sleep

Specific experiences relating to the disaster have also been shown to directly affect sleep problems. For example, in the above study risk of and persistence of sleep problems were also associated with experiencing poor social support and negative life events in the aftermath, as well as directly witnessing the traumatic events (Geng et al., 2013). Similarly, in relation to the Japan earthquake and tsunami Iwadare et al. (2014) found young adolescents more directly impacted through experiences of either bereavement or home damage had a shorter sleep duration compared to those who did not. Following the same disaster, Usami et al. (2014) found across 11,692 children and young adolescents, house damage and evacuation experience were significantly associated with a shorter sleep duration compared to children without these experiences. Likewise, in the aforementioned study by Brown et al. (2011) following Hurricane Katrina, continued house disrepair was also associated with greater severity of sleep disturbance and fear of sleeping alone.

These studies demonstrate that sleep problems, including difficulties with sleep onset and duration, night-waking, sleep quality and therefore daytime functioning, are prevalent in child and adolescent populations in a post-disaster context. Additionally, specific disaster related events such as evacuation and home damage, which could represent level of exposure and severity of the disaster, may be particularly stressful. This could therefore cause a greater level of sleep problems and contribute to long-term sleep disruption. This is plausible as severity of trauma in adult samples has also been associated with increased sleep disturbance (Cox, Tuck, & Olatunji, 2017). However, as with prevalence of PTSD, prevalence of sleep problems must be interpreted with caution. This is because sleep problems and sleep habits pre-disaster are not typically verified. This makes it difficult to determine the exact influence disasters have over sleep (Usami et al., 2013).

The Relationship Between Sleep and Post-Traumatic Stress Disorder

While the above articles stipulate that sleep problems are associated with exposure to disasters, sleep is also highly intertwined with PTSD following a disaster or highly stressful event. While the relationship is complex, an abundance of research highlights the link between the two variables (Cox et al., 2017; Harvey, Jones, & Schmidt, 2003). The majority of research has focused on adult populations in relation to trauma and PTSD, although, there is literature on child and adolescent samples indicating a similar relationship between disaster exposure, PTSD and sleep.

Zhou, Wu, An and Fu (2014) examined the relationship between PTSD symptom clusters according to the DSM-IV (i.e. intrusion, avoidance and hyperarousal), and sleep over 2 years among 350 adolescent survivors of the Wenchuan earthquake. They found that all 3 symptom clusters were associated with sleep problems from 1-2 years post-disaster. Similarly, PTS symptom severity has been found to be greater in children and adolescents

with sleep disturbance across 2.5 years following Hurricane Katrina (Brown et al., 2011), while the prevalence of trouble sleeping was higher in children and adolescents with a high risk of PTSD compared to those with no risk at both 3 and 6 months following an earthquake (Zhang et al., 2015b). These results are not surprising as the association between PTSD and sleep disturbance has been demonstrated in adult samples across a wide variety of traumas, showing that those with PTSD report increased sleep disturbance (Cox et al., 2017). However, there have been less concrete findings when attempting to elucidate causality, i.e. the direction of this relationship.

The role of sleep disturbance in post-traumatic stress disorder. Current research examining the relationship between sleep and PTSD has indicated that sleep may actually play a causal role in PTS symptomology, rather than simply being a characteristic of the disorder (Cox et al., 2017). Fan, Zhou and Liu (2017) found that following an earthquake, sleep disturbance at 1-year in adolescents was significantly associated with increased risk for PTSD at 2-years and predicted the persistence of PTSD. Likewise, Geng et al. (2013) and Zhang et al. (2015b) also found sleep disturbance predictive of PTSD following an earthquake, with trouble sleeping after 3 months being a significant predictor of overall PTSD symptoms after 6 months (Zhang et al., 2015b). Brown et al. (2011) found similar results following Hurricane Katrina as sleep disturbance was predictive of PTSD symptom severity across a 6-month period from 2 years to 2.5 years. Additionally, Zhou et al. (2014) found that sleep problems at 1-year only predicted intrusion symptoms from 1 year to 1.5 years and not to 2 years while it had no significant effects on either avoidance or hyperarousal across 1 to 2 years post-disaster. Overall these studies generally show that post-disaster sleep disturbance can predict post-disaster PTSD over a 3-12 month period, possibly longer in some cases and that this may vary according to the specific PTSD symptom cluster.

This is consistent with other findings which show that sleep disturbance can predict PTSD in the adult literature and that pre-trauma sleep disturbance can also predict the development of PTSD (Babson & Feldner, 2010; Cox et al., 2017). Additionally, it has been demonstrated that while reductions in sleep disturbance and PTSD symptoms tend to co-occur this is not definite as some sleep problems have shown resistance to treatment (Cox et al., 2017). This is curious because if sleep problems are simply a characteristic of PTSD then they should abate alongside PTSD. Moreover, sleep disturbance has been shown to predict improvement of PTSD symptoms. These findings support the proposition that sleep disturbance may in fact play a causal role in the development of PTSD (Cox et al., 2017), possibly by contributing to feelings of fatigue and irritability and therefore interfering with the recovery process (Brown et al, 2011; Cox et al., 217).

The role of post-traumatic stress disorder in sleep disturbance. There have been contradictory findings when taking into account the predictive ability of PTSD and sleep problems in children and adolescents post-disaster, but evidence also supports a more bidirectional relationship (Kovachy et al., 2013; van Liempt, 2012). For instance, Zhang et al. (2015b) found that only hyperarousal after 3 months was a significant predictor of somatic symptoms, including trouble sleeping after 6 months while Geng et al. (2013) found that PTSD was not predictive of sleep problems in their 2.5-year earthquake cohort study. While rare this is not unheard of (Cox et al., 2017). Conversely, Zhou et al. (2014) found that while all PTSD symptom clusters according to the DSM-IV were predictive of sleep problems from 1 year to 1.5 years, only avoidance symptoms could predict sleep problems from 1.5-2 years, showing that the effect of PTSD on sleep decreased over time.

Sleep and hyperarousal. While the direction of causality is still unclear, the literature is consistent in finding an association between sleep and PTS symptomology (Babson & Feldner, 2010). Additionally, in the adult trauma literature hyperarousal has been identified

as a key contributor to sleep disturbance as adults with PTSD who have hyperarousal symptoms report more sleep disturbance than those without hyperarousal symptoms (Cox et al., 2017). A recent study on adult woman also found that those with PTSD with prominent hyperarousal symptoms, compared to those without, had greater sleep disturbance suggesting that hyperarousal symptoms accounts for much of the disrupted sleep and may help explain variations in sleep disturbance in individuals with PTSD (van Wyk, Thomas, Solms, & Lipinska, 2016). It is logical that hyperarousal would cause greater sleep disturbance as it a state of hypervigilance and therefore incompatible with sleep (Dahl & El-Sheikh, 2007; Kahn, Sheppes, & Sadeh, 2013; Peterman, Carper, & Kendall, 2015). Even in a non-disaster population, pre-sleep arousal has been demonstrated to be associated with sleep disturbances in children both in relation to anxiety and not. This is because it interferes with sleep initiation and maintenance as arousal is an opponent process to sleep which requires a lack of responsiveness to the outside environment (Alfano, Pina, Zerr, & Villalta, 2010; Gregory, Willis, Wiggs, & Harvey, 2008; Peterman et al., 2015).

Post-traumatic stress disorder and sleep over time. Due to a lack of longitudinal research on sleep post-disaster, it is still unclear how PTSD and sleep disturbance may change in children over time. Uniquely, Thordardottir, et al. (2015) conducted a 16-year follow up of 286 survivors of a catastrophic avalanche in Iceland. They found a strong association between avalanche exposure and symptoms of hyperarousal specific to the disaster, as well as general sleep impairment and PTSD related sleep disturbances. Out of the survivors, 38% (n = 108) were aged between 2-14 years during the avalanche, demonstrating how the impacts of childhood disasters can have enduring consequences into adulthood. The same authors extended their research to further explore the possible modifying effects of developmental stage at the time of the avalanche disasters in subsequent sleep-related symptomology (Thordardottir et al., 2016). Results demonstrated that manifestations of sleep

disturbances varied according to the individuals developmental stage at the time of disaster exposure. In particular, survivors who were children, aged 2-12 years at the time of disaster were 2.58 times more likely to have PTSD-related sleep disturbances compared to their non-exposed peers. They were also more likely to act out their dreams, for example, kicking, punching, running or screaming while asleep, compared to non-exposed peers. Survivors who were adolescents, aged 13-19 years at the time of disaster were more likely to experience general sleep problems compared to non-exposed peers. These findings suggest that childhood may be a sensitive period for developing persistent general as well as specific trauma-related sleep problems (Thordardottir et al., 2016).

Other Factors which Influence Sleep in Children

Internal Factors. Disasters and highly stressful events are not the only variables that account for sleep problems. Even in the general population, prevalence of sleeping problems in children and adolescents are estimated to range from 25% - 40% and are often persistent (Mindell & Meltzer, 2008). There are a multitude of interacting factors, both internal and external, that can contribute to the development of sleeping problems in non-disaster and non-clinical populations. For example, the sleep-wake cycle is regulated by an internal biological clock on a circadian rhythm of 24-hours (van Geijlswijk, Korzilius, & Smits, 2010). Disruptions to the typical rhythm can result in sleep related disorders such as insomnia or delayed sleep phase disorder. Melatonin is a critical feature of the sleep-wake cycle as it acts on the timing of the mechanisms of sleep, i.e. advances the sleep-wake rhythm by inducing sleepiness (Arendt, 2005; Smits, van der Heijden, Meijer, Coenen, & Kerkhof, 2003). This has been demonstrated through studies which have shown that due to its chronobiotic and sleep-inducing properties, melatonin treatment has been successful in treating chronic sleep-onset insomnia and delayed sleep phase disorder in children (Smits et al., 2003; van Geijlswijk et al., 2010).

Specific cognitions may also impact sleep problems. For example, holding unhelpful beliefs and attitudes about sleep has been associated with sleep disturbance in children, possibly due to concerns around controlling and predicting sleep (Gregory, Cox, Crawford, Holland, & Haravey, 2009). In additional, there is also support indicating that holding a negative attributional style is associated with sleep problems (Gregory & Eley, 2005). It has been suggested that cognitive style may mediate the relationship between anxiety and sleep problems which commonly overlap in the paediatric population (Leahy & Gradisar, 2012). The perpetuation of sleep problems via negative cognitions, such as rumination, has also been demonstrated in the adult literature (Fernández-Mendoza et al., 2010).

External Factors. Alongside internal factors that may contribute to the development of sleep problems, there are also external and environmental factors which can contribute to, maintain and help perpetuate the problem. Good sleep practises, commonly referred to as "sleep hygiene" describes numerous modifiable sleep habits which play a crucial role in the maintenance and perpetuation of child sleep problems, particularly behavioural in nature (K. F. Davis et al., 2004; Moore, 2012). Appropriate sleep hygiene refers to habits which promote sleep initiation and maintenance, whereas inadequate sleep hygiene refers to habits which enhance wakefulness and interrupt sleep, possibly leading to a decrease in quality or quantity of sleep (K. F. Davis et al., 2004). Sleep hygiene encompasses numerous domains including the sleep environment, sleep routine and daytime activities and has consistently proven important to sleep quality (LeBourgeois, Giannotti, Cortesi, Wolfson, & Harsh, 2005; Mindell, Meltzer, Carskadon, & Chervin, 2009; Moore, 2012). For example, having a set bed-time and bed-time routine is often recommended as beneficial. Having a late bedtime, i.e. later than 9pm in children, has been associated with longer sleep onset latencies which contributes to feelings of overtiredness, making it more difficult for the child to fall asleep as over-tiredness in children tends to lead to hyperactivity (Mindell et al., 2009; Moore, 2012).

Later bedtimes and inconsistent routines have also been associated with reduced total sleep time and more night awakenings (Mindell et al., 2009) while regular bedtime routines have been found to be a predictor of better sleep (Sadeh, Mindell, Luedtke, & Wiegand, 2009).

Additionally, children who include reading in their bedtime routine, a commonly recommended practise, have been found to sleep more than children who don't, possibly because it provides greater structure (Mindell et al., 2009). Furthermore, studies have shown that having greater parental control during the bedtime routine has been associated with a number of benefits for children and adolescents. These include having more total sleep, improved daytime wakefulness and less fatigue, lower sleep onset latency, and less nocturnal awakenings, showing that involvement of parents in the bed-time routine is important for overall sleep quality (Esposito, Gnisci, Fabbri, & Cicogna, 2014; Short et al., 2011).

However, while parent involvement in the bedtime routine is important, parental presence at bedtime, i.e. while the child is falling asleep, is detrimental to sleep quality and has been associated with increased night awakenings and less total sleep from infants to school-aged children (Mindell et al., 2009). This is likely related to the child's ability to self-soothe as when the parent is present at sleep onset, they become associated with the conditions needed for sleep and then upon awakening in the night the child struggles to re-initiate sleep without the parent present (K. F. Davis et al., 2004; Mindell, Sadeh, Kohyama, & How, 2010). Furthermore, parenting which encourages independence and self-soothing are associated with extended and more consolidated sleep (Mindell et al., 2010; Sadeh et al., 2009).

Other factors such as caffeine intake, inappropriate day-time napping according to age, lack of daily physical activity, excessive television and gaming or even having a television present in the bedroom have also been associated with less total sleep and greater

sleep disturbance such as delayed sleep onset and increased night awakenings (Alexandru et al., 2006; Garrison, Liekweg, & Christakis, 2011; Mindell et al., 2009; Nixon et al., 2009). Conversely, factors which help facilitate sleep and are associated with better sleep quality include sleeping in a dark, comfortable quite bedroom and having a quiet home environment (Alexandru et al., 2006; Mindell et al., 2009; Spruyt, O'brien, Cluydts, Verleye, & Ferri, 2005). Additionally, co-sleeping or room sharing, while found detrimental and largely rejected in Western cultures (Mindell et al., 2009) has been found beneficial in others (Alexandru et al., 2006). It has been proposed that adequate sleep hygiene may work through a combination of factors such as entraining circadian rhythms, conditioning behaviour, reducing anxiety and environmental stimulation and enhancing relaxation (Galland & Mitchell, 2010).

The family context has also been found to be important in relation to the child's sleep ecology due to the influence parents and the family environment hold (Bell & Belsky, 2008; Dahl & El-Sheikh, 2007). For example, in young children aged 3-4 years old family disorganisation, characterized by a frantic lifestyle and lack of routine was significantly associated with sleep problems. This relationship accounted for sleep problems more so than family environment influences such as specific life events, socioeconomic status and illness (Gregory, Eley, O'Connor, Rijsdijk, & Plomin, 2005). Billows, Gradisar, Dohnt, Johnston and McCappin (2009) extended this study with adolescents to show that family disorganisation was related to sleep onset latency, total sleep time and daytime sleepiness and that this relationship was mediated by sleep hygiene. Family disorganisation may create multiple environmental factors that promote inadequate sleep hygiene and thereby impact sleep quality such as noisy environments, inconsistent bed-time routines and possible modelling of poor sleep habits and practises by parental figures (Billows et al., 2009).

Other family factors which have been associated with children's sleep problems include family and maternal stress, including maternal feelings of incompetence and feelings of restriction with the parenting role and family conflict (Bernert, Merrill, Braithwaite, Van Orden, & Joiner Jr, 2007; Gregory, Caspi, Moffitt, & Poulton, 2006; Kelly & El-Sheikh, 2011; Sadeh, Raviv, & Gruber, 2000; Thunstrom, 1999). An absent father, younger mothers with more negative emotions as well as a mother-child relationship characterized by greater conflict, less closeness and less sensitivity during interactions was also associated with child sleep problems in a study involving 658 children and their families (Bell & Belsky, 2008). In the same study children's sleep problems also adversely effected maternal sensitivity and negative emotionality as well as the maternal-child relationship, demonstrating the reciprocal nature of children's sleep and family functioning (Bell & Belsky, 2008).

An Ecological Perspective on Disaster

It has been suggested that utilizing contextual models of human development such as the ecological model (e.g. Bronfenbrenner, 1979) would be beneficial in disaster research (Noffsinger, Pfefferbaum, Pfefferbaum, Sherrieb, & Norris, 2012; Weems & Overstreet, 2008). This is because such a model would address the child's post-disaster outcomes in relation to the numerous contexts they exist in, not just the family context which is the primary focus of disaster research. For example, Noffsinger et al. (2012) and Weems and Overstreet (2008) both demonstrated effective use of an ecological model in relation to population level research showing the outcomes of disaster. Specifically, Noffsinger et al. (2012) organised known factors influencing children's disaster reactions in the literature according to the five levels of the child's ecology. This included the microsystem, mesosystem, exosystem and macrosystem which will be explained in depth in chapter three. Factors within the microsystem included those within the setting the child lives, for example, the parent-child relationship, while the mesosystem refers to interactions between the child's

microsystems, for example, the home and school (Noffsinger et al., 2012). The exosystem encompasses factors which influence the child indirectly through their impact on the microsystem, for example, institutions, structures and processes such as parental work, environment, mass media and the government. This is an essential system in relation to disaster due to the burden and disruption it places on the exosystem (Noffsinger et al., 2012). Finally, the macrosystem refers to cultural sources of ideology and information, for example, educational, economic, political and legal. Disruption to this level can inhibit effective disaster response and recovery through cultural, social, economic and political structures and process (Noffsinger et al., 2012).

Weems and Overstreet (2008) also used an ecological paradigm to organise research relating solely to Hurricane Katrina. However, they included an ontogenic level so as to encompass factors within the individual that influence developmental adaptation, and which could therefore impact post-disaster functioning, for example, pre-existing mental health problems. The scarcity of research incorporating an ecological model in disaster research limits how we understand children's post-disaster functioning, especially as it has been demonstrated that there is a myriad of factors contributing to children's post-disaster adaptation relating to various levels of the child's ecologies (Noffsinger et al., 2012; Weems & Overstreet, 2008). This is particularly important as natural disasters do not affect singular children and families but whole communities, therefore potentially disrupting all levels of the child's social ecology. Additionally, child development and adaptation, including recovery from disasters, does not occur in isolation from the child's social environment and is therefore best understood in relation to the interconnecting groups, systems and communities (Noffsinger et al., 2012).

Rationale

An abundance of literature has demonstrated the importance of sleep in children, with poor sleep being associated with a host of problems (Zimmerman, 2008). This includes emotional and behavioural difficulties, deficits in neurobehavioral functioning and academic performance, parental distress and poorer wellbeing in family members (Gregory & O'Connor, 2002; Meltzer & Mindell, 2007; Sadeh, Gruber, & Raviv, 2002; Sadeh et al., 2011; Wolfson & Carskadon, 2003; Zimmerman, 2008). The research has also consistently demonstrated that sleep is adversely impacted by stressful events, such as earthquakes (Dogan-Ates, 2010; Norris et al., 2002; Shaw et al., 2012), showing that, as suggested by Sadeh (1996) the sleep-wake system is one of the most vulnerable regulatory systems when exposed to highly stressful and potentially traumatic events. Additionally, it has been proposed that sleep is important for recovery from highly stressful or potentially traumatic events (Babson & Feldner, 2010; Germain, 2013). This is of concern as it means that children in a post-disaster context, such as Christchurch, are dealing with the direct effects of the earthquake, including sleep problems as well as the consequences of the sleep problems themselves including the possible impact this has on their recovery process.

While the importance of sleep has been clearly articulated, there is a lack of research that comprehensively delves into families' experiences of children's sleep problems and the factors that may help maintain them for a prolonged period of time in a post-earthquake context. The existing research is largely quantitative in nature and while this provides crucial information, qualitative research allows for the participants' experiences, thoughts and feelings to be demonstrated, illustrating the reality of coping with a natural disaster and all its effects. These areas are important as it will help elucidate factors contributing to long-term sleep problems post-earthquake.

The aim of this study will therefore be to evaluate children's sleep problems in a post-disaster context, including taking into account the families experiences and factors which may be contributing to and perpetuating sleep difficulties. This will be done using a unique design which is qualitative in nature but also guided using an ecological-transactional framework and clinical reasoning processes to create an analysis across participants based on the process of formulation.

Research Questions

The research questions are:

1. What ecological factors, and transactions between them are identified by families as contributing to the presenting sleep problems?

2. What can a clinical reasoning analysis, based on the principles of formulation contribute to our understanding of possible mechanisms of effect for these families?

Chapter 3

Methodology

The Researcher and Origins of the Study

At the time of this project I was completing the Child and Family Psychology programme at the University of Canterbury. This would have therefore influenced how I gathered data as I drew on techniques and skills taught through the programme and it would have also acted as the lens in which I interpreted data. In addition, I was born and raised in Christchurch and experienced the Canterbury earthquakes, being situated in the Eastern Suburbs which were among the most affected areas. My own experiences of the earthquakes, including knowledge of how they had impacted individuals in the community was a large motivator for pursuing this study. However, my personal interest and experiences also provides room for bias. For example, I had to ensure personal experiences and thoughts did not influence the collection or interpretation of the data. Throughout the completion of this study I made sure to be aware of any bias that arose and to minimize this as much as was possible. These efforts are described later in the chapter.

This project arose out of a broader research project, the *Juniors Settling in and Learning Study*, which began in 2013 and has been investigating the impact of the Canterbury earthquakes on children. Data from this research showed that many children were suffering from sleeping problems at a higher rate after the earthquakes compared to before the earthquakes (Liberty, 2017). This is a typical finding in a post-disaster community as sleep problems are common in both children and adults after disasters or highly stressful events (Charuvastra & Cloitre, 2009; Shaw et al., 2012). While there is research on children's post-

disaster functioning, including sleep problems, there is little qualitative research that delves comprehensively into sleep problems in a post-disaster context.

Design

The current study adopted a novel design using qualitative content analysis in the context of clinical reasoning around an ecological-transactional framework across multiple participants. The design will be outlined first and then the type of content analysis used in this study, along with the ecological-transactional framework will be explained in depth.

The advantage of qualitative research is in the richness of the data collected (Moretti et al., 2011), as, according to Braun and Clarke (2013), it "…captures the complexity, mess and contradiction that characterises the real world, yet allows us to make sense of patterns of meaning" (p.7). At its most basic, qualitative research uses words as data (Braun & Clarke, 2013). This study utilized a *conventional* approach (Hsieh & Shannon, 2005) to content analysis in order to capture the 'meaning' of the participants, i.e. their thoughts on the cause and effect of the child's sleep problems. However, content analysis was abductive, rather than deductive or inductive which is typical of conventional content analysis. An inductive approach is used when there is little knowledge on the phenomena. Extracted information is therefore derived from the data, moving from the specific to the general, for example inductive content analysis may be used in theory production. A deductive approach is used when there is knowledge on the phenomena and so the structure of the analysis is based on existing theories or models (Elo & Kyngäs, 2008). An abductive method utilizes clinical reasoning and is a form of inference which moves from phenomena, i.e. descriptions of data patterns, to plausible explanations of the phenomena, i.e. causal mechanisms. An abductive method was therefore more suitable as, it helped to focus the researcher on aspects of the data which could contribute to the analysis (i.e. possible explanations) of the children's sleep problems (Vertue & Haig, 2008).

This study also adapted the traditional qualitative approach by incorporating an ecological-transactional framework and clinical reasoning. The ecological-transactional framework, described in full below, is a model for understanding human development. It is beneficial for this study as it provides a contextualized approach to understanding the development of the children's sleep problems in light of the earthquakes. Importantly, this is done in accordance to the factors identified by parents, including their thoughts on how these factors may have interacted with each other to contribute to the child's current presentation. Here, the 'meaning' of the participants is paramount.

However, in also utilizing clinical reasoning, the 'meaning' shifts from that of the participant to the researcher. This is because clinical reasoning is the decision-making process employed in the description of an individual's presenting difficulties, i.e. the child's sleep problems (Vertue & Haig, 2008). Therefore, the final analysis based on the process of formulation in the context of clinical reasoning was based on the 'meaning' of the researcher, in accordance with the literature. Although, the factors extracted for the analysis were still those identified by the participants. Using the process of formulation in conjunction with clinical reasoning to guide the final analysis was necessary as an ecological-transactional analysis alone would not be able to answer the aim of the study, i.e. to evaluate the children's sleep problems in a post-disaster context while also taking into account the families experiences and factors, identified by the participants, which may be contributing to and perpetuating the sleep problems .

Qualitative Content Analysis. Content analysis is a method used to provide knowledge and understanding of specific phenomena, (i.e. children's sleep problems in a post-earthquake context), through the subjective interpretation of data (i.e. whole interviews), which is classified through the process of coding and identification of related themes (Downe-Wamboldt, 1992; Hsieh & Shannon, 2005). Content analysis for the current study

was based on a *conventional* approach which is defined as a technique used to describe a phenomenon, i.e. the presenting sleep problems, when existing theory or research on the phenomena is limited (Hsieh & Shannon, 2005). In this case, while there is research on children's sleep problems post-disaster, there is no qualitative research in a post-disaster context which also utilizes an ecological-transactional framework based on individual families' experiences rather than population level data. Using an ecological-transactional framework in conjunction with conventional context analysis is beneficial as it will allow participants' understandings of factors contributing to the child's current sleep presentation, to be organised across a range of systemic levels, often not considered within psychological research. Qualitative content analysis therefore allowed the extraction of themes which were directly relevant, meaningful and representative of the data provided by participants, (i.e. their experiences, thoughts and feelings around the earthquake and children's sleep problems including other possible contributing factors).

When the primary form of data collection is through interviews, which is the case with the current study, then open-ended questions and probes related to participants comments are used to ensure the information is based on the participants' thoughts and experiences rather than existing theory (Hsieh & Shannon, 2005). Conventional content analysis involves immersing oneself in the data by reading the interviews numerous times until the researcher has gained a comprehensive understanding of the data. Following this, data is coded. This is done by reading the text word by word and taking note of possible key concepts or thoughts, including the researcher's first impressions (Hsieh & Shannon, 2005). This process continues until codes emerge which reflect multiple thoughts. These codes are then grouped into meaningful categories based on their relatedness to each other. Grouping codes together in a meaningful way is important as it will better illustrate patterns in the data and therefore help provide understanding on the phenomena in question (Hsieh & Shannon,

2005; Miles & Huberman, 1994). As this process continues themes will begin to emerge that can define groups of codes as well as their relationship to each other. Themes may be derived either directly from the text or through the analytic process and as such, the use of preconceived categories are avoided. Therefore, themes come directly from the data and should relate to the participants' thoughts and experiences (Hsieh & Shannon, 2005; Kondracki, Wellman, & Amundson, 2002).

An Ecological-Transactional Framework. Following the process of content analysis, a further analysis within an ecological-transactional framework was performed. Specifically, themes which had been extracted via the process of content analysis were organised according to the levels of Cicchetti et al.'s (2000) ecological-transactional framework, based on Bronfenbrenner's (1977) ecological model. This allowed for an in-depth multi-level analysis of the various factors identified by participants which may have been be contributing to the presenting sleep problems.

The ecological model first proposed by Urie Bronfenbrenner (1977) emphasizes the equal role that the environment, contextual and family factors have on human development. This model places the child in the middle of a set of nested structures which represent the environments that influence the child. First proposed by Belsky (1980) and included in Cicchetti et al. (2000) is the consideration of ontogenic development. Here, overall adaptation is determined based on the child's ability to successfully negotiate salient tasks such as physiological regulation or the modulation of attention and arousal. Inability to do so may put the child at risk for the development of maladaptive consequences (Cicchetti et al., 2000; Sroufe & Rutter, 1989), for example, sleep problems. The consideration of ontogenic development is crucial for this study as aspects within the child, such as the inability to modulate arousal, would directly contribute to the development and maintenance of sleep problems.

The microsystem is the most immediate level of the ecological-transactional framework. According to Cicchetti et al. (2000) the microsystem includes the family environment and settings which contain the child such as the home and school. It also includes family dynamics such as parenting styles and the developmental histories and psychological resources of the parents. Using Cicchetti et al's. (2000) framework, the next level is the exosystem. This system contains all social settings that compose the immediate environment of the child and family. However, these social settings do not directly affect the child, but rather influence the child's development through their effect on the microsystem. Cicchetti el al's exosystem also encompasses Bronfenbrenner's "mesosystem" which is made up of the interconnections between the microsystems (Bronfenbrenner, 1979). The outermost structure of the ecological-transactional framework is the macrosystem which includes wider societal and cultural values and beliefs that permeate individual and family life (Cicchetti et al., 2000).

An ecological-transactional framework also takes into account four levels of primary risk. This includes enduring vulnerability factors, transient challengers, enduring protective factors and transient buffers (Cicchetti et al., 2000). According to this framework, sleep problems will have occurred because the potentiating factors (enduring vulnerability factors and transient challengers) outweigh the compensatory factors (enduring protective factors and transient buffers) which increase and decrease risk respectively (Cicchetti et al., 2000). Clinical reasoning may be beneficial here and add to this analysis by addressing any explanations in accordance with the literature that participants posed may not fit within an ecological-transactional framework.

One of the reasons Cicchetti et al's. (2000) ecological-transactional framework is beneficial for this study is its emphasis on the impact of proximal factors within the more immediate ecologies. While the model typically conceptualizes the various environmental

levels as mutually influencing, Cicchetti et al. (2000) proposes that the most immediate ecologies have the most direct impact on development due to proximal rather than distal factors. This provides a framework with an emphasis on the microsystem, which is fundamental for this study as sleep problems should be considered in the context of the family due to the known influence parents and the family environment can have on sleep (Gregory & Sadeh, 2012; Bell & Belsky, 2008). Similarly, the inclusion of the ontological system in Cicchetti et al's. (2000) framework is critical because of the possible impact that the earthquakes can have on the child's development due to the impact of chronic stress on neurological processes (De Bellis & Zisk, 2014). Cicchetti et al. (2000) also utilizes a beneficial organisational perspective on development, as it acknowledges the impact early experiences, such as the earthquakes, can have on subsequent development. Additionally, an ecological-transactional framework is highlights as it acknowledges the transactional nature of factors within and across the child's ecologies and how these factors may have influenced each other to allow for the onset and perpetuation of sleep problems in the context of the earthquakes.

Methods

Ethical approval and considerations. Ethical approval was obtained from the University of Canterbury Human Ethics Committee (see Appendix A) on 3 July 2017 while an amendment was obtained on 30 August 2017 (see Appendix B). All parents were provided with a brief letter outlining the study (see Appendix C) and an information sheet detailing the study in full (see Appendix D). Parents were provided with a consent form for themselves (see Appendix E) along with a consent form for allowing their child to participate (see Appendix F). Ethics approval included for the children to be interviewed as well, so an assent

form was provided to children with information in terms appropriate for their age (see Appendix G).

According to Kaiser (2009), one of the difficulties of qualitative research is reporting detailed and accurate accounts of the participants' world while also protecting their identity. Therefore, care must be taken when handling sensitive information and in order to protect participants' identity precautions such as concealing or removing highly sensitive information must be taken (McLellan, MacQueen, & Neidig, 2003). In the current study this was done by pooling all data from participants together in the analysis and information which may have identified participants was removed. Therefore, the final analysis was based on the pooled factors emerging from the analytic process across all participants to ensure nothing could be traced back to any participants. This is particularly important when dealing with vulnerable populations such as children (Kaiser, 2009).

Recruitment. Three of the four families were recruited through the researcher's secondary supervisor, Associate Professor Kathleen Liberty from schools she had come in contact with through her research on children's learning and behaviour following the earthquakes. The final participant was recruited via a family friend of the researchers who had expressed interested in the study. Inclusion criteria were that participants: 1) spoke English; 2) were affected by the Christchurch September 2010 and February 2011 earthquakes and/or the Kaikoura 2016 earthquake; 3) had a sleep-related problem with post-earthquake onset or deterioration and; 4) were able to participate in interviews. Interested parents were provided a letter with a brief description of the study. If parents were interested in hearing more or in becoming part of the study, they were instructed to contact either Associate Professor Kathleen Liberty or the primary researcher by phone or email.

Participants. Four families agreed to participate in this study. In total this included four children, ages 9-11 years old, four mothers and one father. The make-up of families differed, for example, the number of family members living in the household and whether the parents were separated. The families were affected by either the Christchurch (September 2010, and/or February 2011) or the Kaikoura earthquakes and at the time lived in a range of areas from those suffering minimal damage to among the hardest hit.

Sleep problems. The children presented with numerous sleep problems making them eligible for the current study. These included behavioural sleep problems such as co-sleeping, room-sharing bed-time resistance, night-waking and delayed sleep onset. Parasomnias and anxiety-based sleep problems included nightmares and nocturnal enuresis. Parents described all the sleep problems as long-standing, believing their onset and/or deterioration was a direct consequence of the child's earthquake experiences.

Measures

Semi-structured interview. Semi-structured interviews were used as they are able to remain flexible while covering a pre-determined number of topics or questions (Edwards & Holland, 2013). This was an essential component in capturing participants' unique experiences while being able to answer the broader research questions. This approach gives more power and control of the direction of the interview and what is discussed to the interviewee (Saks & Allsop, 2007). In doing so, semi-structures interviews allow for the experiences, feelings, and perceptions of the participants to be truthfully captured, while also giving meaning to these experiences (Edwards & Holland, 2013; Saks & Allsop, 2007). This was vital in providing a comprehensive and detailed analysis of participants' experiences relating to the earthquakes as well with the children's' sleep problems.

Interviews were structured around the levels of the ecological analysis in order to discuss with the participants both proximal and distal factors that may have impacted on the children's sleep problems, earthquake experiences and their subsequent effects. These ranged from ontological factors in the children's early development to more distal factors in the child's outer ecologies. Questions were kept broad and open to capture the interviewee's thoughts and to make sure the interview was directed by the interviewee rather than specific questions based on preconceived ideas about what we may have expected to find. Additional information was gained through the frequent use of open-ended prompts, for example, "tell me more about …" The guideline of the interview format is as follows:

1. Tell me about your child's sleep at the moment.

a. How do you make sense of these problems?

b. How have you handled these problems?

2. Tell me about your families' earthquake experience.

a. Tell me how the earthquakes affected you and your family.

b. Tell me how the earthquakes affected your child.

c. Tell me about any ongoing problems or difficulties you have had because of the earthquakes.

3. Tell me about (child's) development so far.

4. Tell me about any other big events your family has been through aside from the earthquakes.

The interviews used open questions to encourage full disclose of parents' experiences and perceptions. Towards the end of the interview questions such as "Was there anything else

you thought might have impacted your child's sleep which we have not yet covered?" were asked to gather possibly missing information. Specific information about the child's sleep and its current environmental context was also gathered using a modified version of the Sleep Assessment and Treatment Tool (SATT; Jin, Hanley & Beaulieu, 2013) as needed. These questions were more specific in order to determine the current sleep problems and environmental variables that may be associated with each child's sleep problems, for example, "Describe what takes place during the ½ hour prior to your child going to bed for sleep".

Of the four children, one was able to be interviewed about their own sleep and other relevant experiences. This included their views on the earthquakes and the role they believed this had on the development of their sleep. Including the child in the interview process is beneficial as it allows their perception of their sleep and what they find relevant to be determined. The child interview was conducted similarly to the parent interviews through the use of broad, open-ended questions, for example, "Tell me about your sleep". Additional prompts were used as needed as with the parent interviews. Determining whether questions relating to the earthquakes would be asked was decided based on the individual child and family. This was an important ethical consideration because for some children these questions may have caused unnecessary distress.

Sleep diary. A sleep diary was provided to parents to report on their child's sleep for one week (see Appendix H). Sleep diaries have demonstrated satisfactory levels of accuracy, are the most common method for gathering data about children's sleep (Blampied, 2013; Richman, Douglas, Hunt, Lansdown, & Levere, 1985), and can obtain important information about problems that occur outside of the bedroom and during the day (Jin, Hanley, & Beaulieu, 2013). The sleep diaries were provided by the Pukemanu/Dovedale Centre and

recorded sleep habits such as where the child fell asleep, curtain calls and parental responses, and night time waking and parental responses.

Questionnaires. The 'Child Sleep Habits Questionnaire' (CSHQ; Owens, Spirito, & McGuinn, 2000) was used to gain information about the children's sleep habits and possible difficulties with sleep (see Appendix I). Parents reported on their child's sleep in the past week, responding to 33 questions; for example, "child awakens once during the night". Parents answered questions on a 3-point Likert-type scale ranging from 1 (usually; 5-7 times per week), to 3 (rarely; 0-1 times per week) and provided information on their child's bedtime, wake time, and usual amount of sleep at night and naps during the day. Additionally, parents had to indicate whether item was considered a problem by circling either "yes", "no", or "N/A".

The 'Sleep Self Report' (SSR; Owens, Spirito, McGuinn, & Nobile, 2000) was used to gauge the child's perception of their own sleeping habits and possible difficulties they may be having (see Appendix J). Children answered 3 general questions about their sleep, for example, "do you think you have trouble sleeping?", as well as 23 more specific questions, for example, "are you afraid of sleeping alone?", on a 3-point Likert scale. This ranged from 3 (usually; 5-7 times per week) to 1 (rarely; 0-1 times per week/never). Six reverse scored items were included in this scale.

Procedures. Parents who had expressed interest in the study were contacted by telephone or email to provide additional information regarding the study, including what involvement would entail for themselves and their child. During the initial meeting the researcher first went through information and consent forms with the parent and they were provided the opportunity to ask questions. Interviews proceeded once parents had signed the consent forms. Interviews ranged from approximately one to two hours in length with follow

up interviews scheduled as needed. Following the initial interview parents were provided with the relevant questionnaires and sleep diary which were explained in depth with the opportunity for parents to ask questions. The questionnaires and sleep diary were completed and returned at a subsequent interview or collected directly from participants at an agreed upon time.

Due to the sensitive nature of the topic and its potential to cause distress, it was made clear that both child and the parents could take a break at any time during interviews or terminate them if necessary. The researcher took time to establish rapport, make sure participants were comfortable at the beginning of the interview, took care in asking questions and showed empathy if difficult experiences arose to make sure no undue distress or anxiety was caused. Particular care was taken prior to conducting the child interview. This involved contacting parents in advance to seek verbal parental permission around what types of questions they were comfortable being discussed. This was a necessary ethical consideration in order to ensure no unnecessary distress was caused. Participants were provided the opportunity to view their transcripts and omit any data from the final publication if they wished.

Data summation and analysis. The unit of analysis for the current study was whole interviews. The first step of the analytic process involved the researcher first reading through the transcripts in detail and making note of any thoughts that came up, as well as key words or phrases that appeared to capture key concepts. The researcher then re-read the transcripts and coded the data numerous times to ensure reliability and validity. Codes were continuously refined through the process of condensation which refers to shortening the phrase or keywords while still preserving its meaning (Graneheim & Lundman, 2004). Related codes were then organised into categories and in doing so initial themes began to emerge. Codes and themes were reorganised and refined multiple times. Throughout this

process the researcher referred back to the data in order to ensure codes and themes were representative of the participants' thoughts and experiences. These codes and themes were discussed at length with the researcher's primary supervisor, a clinical psychologist with experience in both sleep and qualitative research. Following such discussions codes and themes were re-organised and again discussed with the researcher's primary supervisor. This process involved many hours of discussion and continued until coherent logical codes and themes were established which accurately reflected the participants voice. In addition, a Masters level student separately read 30% of transcripts and checked codes to increase inter-rater reliability. Any discrepancies were discussed, and codes were refined until agreement was 100%. Information from the questionnaires and sleep diaries across participants were examined to supplement information and codes based on interviews. Triangulation of data helped to ensure codes were consistent across multiple sources of information and could therefore be deemed reliable. This means the researcher could have confidence that the codes could contribute to an analysis which would provide the best explanation for the onset and development of the presenting sleep problems in the context of the Canterbury and/or Kaikoura earthquakes.

Following this an ecological analysis was conducted. This involved organising the themes according to the levels of the ecological-transactional framework including the classification of themes as either enduring or transient risk or protective factors. Relationships between themes and their influence on each other were also depicted, as identified by participants. The clinical analysis was based on the process of formulation which is a convergent process of integrating data from multiple sources using clinical reasoning and understanding so that the relationships among the data are identified (Connor & Fisher, 1997). By also employing an abductive approach, the clinical reasoning process was not only used for the detection of phenomena described by the participants but also their

possible explanations (Vertue & Haig, 2008). This is because the abductive method focuses on the explanation of phenomena rather than description (inductive) or transmission (deductive) (Patel, Arocha, & Zhang, 2005; Vertue & Haig, 2008). This would therefore help guide the researcher towards an explanation, grounded in appropriate literature and theory, which could account for the development or deterioration of sleep problems following the Christchurch and/or Kaikoura earthquakes. In basing the final analysis on formulation, clinical terminology was therefore used. This included predisposing, precipitating, perpetuating and protective factors according to Havighurst and Downey's (2009) formulation model. Predisposing factors are those which could have possibly increased the child's risk of experiencing sleep problems. Precipitating factors are events or factors which exacerbated possible predisposing factors and therefore triggered the sleep problems or other difficulties. Perpetuating factors are those which have helped maintain the child's difficulties, and protective factors are strengths of the child and family which may have helped protect them against various vulnerabilities and challengers. These terms were mapped onto and used in conjunction with the classifications within the ecological-transactional framework in clinical analysis. Table 1 shows how the classifications used in an ecological-transactional framework correspond with those used in a clinical analysis. These terms were used collaboratively throughout the analysis. However, while deliberately left out of the Table 1, it should be noted that precipitating and enduring vulnerability factors are talked about together in relation to the earthquakes. This has not been put in the Table 1 as it is not typical to combine such factors. An exception was made in this case when considering the earthquakes and their effects because of the complexity in categorizing such factors. This will be further explained in Chapter 5.

Table 1: *Ecological-transactional classifications with corresponding clinical classifications*

Ecological-transactional classifications	Clinical classifications
Enduring vulnerability factors	Predisposing factors Perpetuating factors
Transient challengers	Precipitating factors Perpetuating factors
Enduring protective factors	Protective factors
Buffers	Protective factors

Truthfulness, Rigor and Integrity of the Data. Trustworthiness refers to the degree of confidence a researcher can have in their data (Polit & Beck, 2012). According to Granehaim and Lundman (2004), when considering trustworthiness, an essential problem is the degree of interpretation used with a text owing to the multiple meanings it may hold. In order to evaluate the degree of trustworthiness present specific strategies must be implemented. Elo et al. (2014) state that the most widely used criteria for establishing the trustworthiness of qualitative content analysis are those proposed by Lincoln and Guba (1985). These were used in the current study and include credibility, dependability transferability, confirmability and authenticity.

Credibility refers to the degree of confidence one can have in the truth and interpretation of the data; that it truthfully represents the participants experiences and meanings (Elliott, Fischer, & Rennie, 1999; Polit & Beck, 2012). To increase credibility of the current study the following methods were employed:

- Peer-review: a Masters level student and the researcher's primary supervisor helped triangulate interpretation of transcripts. A collaborative analytic process enhanced the

likelihood that the information reflected genuine themes and factors in the participants lives and minimized the likelihood that individual bias occurred.

- Member-checks: participants were given the opportunity to read their transcripts and request they be altered if it did not best reflect their perceptions and experiences.
- Triangulation: data from interviews was triangulated against multiple data sources, including a sleep diary, the Sleep Habits Questionnaire and the Child Self Report questionnaire to ensure accuracy.

Dependability refers to the stability of data, that is, whether the findings could be repeated if the study were replicated with the same or similar participants in the same context (Elo et al., 2014; Shenton, 2004). In this study dependability was increased by:

- Two other researchers triangulated data coding including the researchers' primary supervisor, who is familiar with qualitative research and oversaw the project, as well as a Masters level student.
- Comprehensively detailing the design, data collection procedures as well as acknowledging any limitations.

Transferability refers to the degree that findings can be transferred and have applicability to other settings or groups, as well as to whether others not involved in the study can relate to the results in light of their own experiences (Elo et al., 2014; Polit & Beck, 2012; Shenton, 2004). In this study transferability was done by:

- Providing basic descriptive data of participants such as age and location during the earthquakes.
- Providing the context of the study in detail, thereby allowing others the chance to relate in comparison to their own experiences. This also makes it clear what settings these findings may apply to as well as their boundaries.

Confirmability refers to the degree that data accurately represents information provided by the participants and that the interpretations are objective, reflecting the participants' voice and not researcher bias (Polit & Beck, 2012; Shenton, 2004). In this study confirmability was addressed by:

- Giving participants the opportunity to reflect and comment on the findings and accuracy of interpretations.
- The researcher was aware of and stated any personal beliefs, motivations or biases that may have influenced interpretation. Triangulation of data also helped minimise any possible researcher bias.

Authenticity refers to the degree that the researchers are able to portray the 'tone' of the participants' lives, giving the reader a full understanding of the participant's experience (Elliott et al., 1999; Polit & Beck, 2012). In this study authenticity was done by:

- Grounding in examples – providing examples of the codes and themes, explained in the participants' own words, while maintaining and respecting the participant's anonymity.
- Immersing oneself in the data in order to provide the opportunity for new insight.

Chapter 4

Results

The following section will begin by detailing how data collection differed from what was proposed in the methods section. Following this the results will be portrayed in a series of tables. These tables will illustrate the themes and codes extracted throughout the process of data analysis which relate to the participants' earthquake experiences and the subsequent development and/or deterioration of the children's sleep problems. Interactions between themes according to the parents have also been identified. Exemplar codes and quotes from the participants will be included to demonstrate what the themes encompass, that is, to provide the reader, through the participants' words, with a fuller description of their experiences, thoughts and feelings.

Context of the Data Collection

The reality of participant participation in data collection differed compared to the planned study. It was planned that across the four families, five parents would complete the child sleep diary, questionnaire and participate in interviews while four children would complete one questionnaire and participate in one interview. In total, three parents completed the questionnaires, child sleep diaries and interviews, although only mothers participated, while one child completed the interview and questionnaire.

The two parents from one family were unable to complete the questionnaire and child sleep diary due to change in family circumstance but both parents completed interviews. One child was unable to participate at all due to the same family circumstances while two were able to complete the questionnaire but unable to participate in an interview due to their own

or parents' wishes. As only one child participated in an interview, interview data from parents and the child were considered as a whole so as not to expose the child.

Participant Characteristics

Overall, four children had a total of 16 different sleep problems. Some children also presented with behavioural problems and had coexisting disorders such as oppositional defiant disorder (ODD) and attention deficit hyperactivity disorder (ADHD). At the time of the September 2010 earthquake, the participating children ranged in age from 3 to 4 years.

Illustration of the Themes using Codes and the Participants' Voices

Throughout the process of content analysis, guided by clinical reasoning, 34 themes were extracted. These were in relation to these families' earthquake experience, the children's sleep problems, and other difficulties, as well as other risk and protective factors that may have impacted these families' current situation and children's presentation. Most themes encompassed numerous codes, however, some themes had no codes. This occurred when the themes had enough explanatory breadth in themselves to cover the meaning of the codes under them. All themes are listed in Table 2. Adjacent to each theme is one or two exemplar codes (the full list of codes for each theme are found in Appendix K) which give the reader a more specific example of what kinds of factors the themes encompass. When no codes are applicable, "N/A" will be stated. In the third column data is displayed in the form of quotes directly from the participants. These are used to demonstrate what the specific code and related theme mean to the family, and to ensure the participants voice is heard.

Table 2

Summary of themes and exemplar codes with corresponding quotes from participants

Theme	Exemplar Code	Example Data
Early developmental adversities	Developmental delays and abnormalities	*"... he wasn't talking and when he'd talk he'd get out words and he'd know what he was saying but we couldn't understand him…"*
Possible predisposition to sleep problems	Consistent night-waking in infancy and sleep problems throughout early childhood	*"Well she's never been a good sleeper, even when she was a baby she woke often…"*
Behavioural sleep problems	Bed-time resistance	*"...* [bed-time was] *just such a fight, a battle to go to bed. Not wanting to go to bed"*
Parasomnias and anxiety-based sleep problems	Nightmares	*"…she still gets nightmares…"*
Child well-being and psychopathology	High level of child worries	*"…she gets quite wound up…and it's like come on…you don't need to be stressing about that, but she does".*
Emotional and behavioural problems	Unpredictable behaviour	*"…he can just turn…he can be the perfect angel child…and other times he's like a monster and he throws things…"*
Child's earthquake-related externalizing and internalizing problems	Aftershocks trigger physiological response in child	*"…I hold her, and I can feel her heart just racing like it's terrifying for her, even a little shake…"*
Parental wellbeing and psychopathology	Parental stress	*"I* [mother] *do stress easily, yeah, I do stress very easily, I tend to worry as well".*
Maternal earthquake related anxiety about the child	Maternal anxiety on separation from child	*"…sending them to school made me feel sick, like not having them with me and that thought of what if I can't get to them".*

Theme	Exemplar Code	Example Data
Parental conflict	Parental antisocial behaviour due to parental conflict	*"…she'll* [mother] *throw stuff and say stuff she doesn't mean to me…"*
Parental responses to child's sleep and behaviour problems	Parental presence at sleep onset	*"…he wouldn't go to sleep unless one of us was in his room and with him at all times…"*
The families' earthquake experience and its immediate effects	Strong immediate parental emotional response	*"…and of course, not being able to contact her* [daughter] *it's like a panic and not knowing…"*
	Child distressed, anxious or uncommunicative about earthquake	*"…he* [father] *came rushing out and he went and grabbed* [child] *'cos she was screaming…"*
		"…[child] *didn't really talk about it* [earthquakes]*…"*
Ongoing effects of the earthquakes	Practical difficulties following the earthquakes	*"…we had our repairs done a couple of years ago now, but it was a long wait…"*
Family history of anxiety	N/A	*"…chances are pretty good that there's that genetic link with …* [anxiety] *as well unfortunately".*
Widespread availability of information	Mass media communicates earthquake threats	*"I guess in New Zealand, in the media, there's that constant, when's the next big one, the Cook Strait, (earthquake) all the time…"*
Greater flexibility of buildings	N/A	*"…it's like that flexi-floor so it's built to move…"*
Peer difficulties unrelated to the earthquakes	Child bullied at previous school	*"…* [child had] *trouble being bullied at school…"*
Peers earthquake related anxiety	Peers strongly affected by earthquakes including anxiety	*"…I know some of her classmates were really traumatized by it".*
Other non-earthquake related family stressors	N/A	*"…things have been pretty tense between* us [family and others]*".*

Theme	Exemplar Code	Example Data
Unsuccessful strategies for solving sleep problems	Stop-watch and countdown strategy to cue bed-time transition	*"…two minutes and its bed and just* [child gets angry], *I'm not going to bed…and then all hell breaks loose…"*
Internal parental cognitions about their child's sleep and behaviour problems	Mother initially believed child's age protected her from earthquake	*"…she was 3 … so I kind of thought … she didn't understand what was happening…"*
Non-earthquake related exosystem stressors	Family job loss and associated short-term financial hardship	*"…was really dedicated but he couldn't do his normal job".*
Negative earthquake related changes in the community	Negative atmosphere in the city due to the impact of earthquake related stressors on the community	*"…I think generally there's been a black cloud over most people and you kind of don't notice when you're here but when you go to another city there's just a lightness, just hardens you a bit I guess".*
Child able to sleep at times without disturbance	Child able to sleep in own bed	*"…he's taken himself to bed a few times when he's tired, … if he gets snotty* [angry] *he'll take himself to bed and just go to sleep himself…"*
Protective developmental factors	No maternal concerns with child's development Good cognitive ability	*"…she is really high functioning* [bright] *so there hasn't been any issues there".* *"…* [child's] *very bright, very imaginative. School she's just kind of cruising along, academically I'm not worried…"*
Strength of parental relationship	N/A	*"…we were really good as a team …"*
Helpful parental responses to child's sleep and behaviour problems	Appropriate sleep hygiene practises	*"…if we had that quiet time* [reading] *like that in bed then that helps him calm and relax and settle…"*

Theme	Exemplar Code	Example Data
Positive earthquake related changes in the community	More supportive and peaceful community with improvement in the city atmosphere as the city was rebuilt	*"...* [negative city atmosphere] *is slowly lifting …and it's a lot quieter now…and I feel like we probably know them* [neighbours] *in a way we might not have if not for the quakes…I feel like we've got each other's backs…"*
Availability of adult support services	Parental engagement with mental health and addiction services	*"... I did go to a few sessions a while ago".*
Intermittent improvement in child's sleep problems over time	Sleep problems slowly improving	*"...for the last couple of years it's been really difficult but now it's starting to drop and level out a bit more".*
Intermittent improvement in child's behaviour problems over time	Behaviour problems slowly improving	*"...it's better than that now, we've definitely made some progress".*
Social supports post-disaster	Supportive friends and family	*"...we all went back to Mum and Dad's...* [after the earthquakes]*"*
Community supports post-disaster	N/A	*"...it was quite a caring community".*
Adapting to an earthquake prone city	Children had to learn earthquake safety procedures	*"...they'd go under the doorway or something 'cos I'd said to them things change, you know what to do..."*

Interactions between Factors as Identified by Parents

Throughout the process of content analysis certain codes emerged which illustrated the interactions between factors as identified by the parents. This was clear as these codes incorporated factors relating to two themes rather than one. This therefore also demonstrated how themes may be related. For example, the code "maternal anxiety due to early developmental adversities" shows that the mother was anxious about her child's

developmental adversities. These codes will be displayed in Table 3. Adjacent to the codes will be the data, i.e. quotes from participants. These quotes depict the relationship between specific factors in the participants own words, therefore supporting the code by showing its origin. This Table builds on the previous by depicting different codes and by beginning to demonstrate how the above themes relate to each other. By doing so, the reader is given a clearer picture of how factors have interacted in order to contribute to the participants current situations.

Table 3

Codes and quotes from participants demonstrating interactions between themes

Codes	Data
Maternal anxiety due to early developmental adversities	*"...* [mother] *was anxious* [because of child's developmental adversities] *right up until he turned five".*
Maternal earthquake related anxiety reinforced the child's anxiety	*"...I probably put more fear into my children because of the way I was freaked out".*
Child anxiety negatively impacts child's sleep	*"I think* [child's sleep problems are due to] *anxiety".*
Negative impact of child's sleep problems on child wellbeing, development/education and rest	*"...the poor wee thing is just shattered* [from sleep deprivation] *most of the time...* [and child has] *a really short wick* [when sleep deprived] … *and she's obviously not learning well...if she's tired all the time".*
Negative impact of child's sleep problems on family wellbeing, rest and relationships	*"...no one would get any sleep and .. would...start yelling at [Child]…..then I'd start yelling at .. for yelling at [Child]..."*
Emotional and behaviour problems stressful for family	*"...huge meltdowns all the time...you can imagine that placed stress on the rest of the family, so it was pretty horrendous".*
Maternal depression related to fatigue from family conflict	*"... it's* [depression] *just because I'm tired and sick and tired of battles...* [with family]*"*
Pre and post-earthquake parental conflict related to mental health problems	*"...I don't realise until halfway through an argument of debate that this* [mental health problems] *is what the cause* [of the parental conflict] *is...*
Pre and post-earthquake conflict related to earthquake and other difficulties	*"...my husband and I fighting and...external stressors...our relationship* [was impacted by the earthquakes] …"
Parental relationship strain from earthquake	*"...we were pretty stressed...* [during earthquake period]*"*
Parental conflict post-earthquake exacerbates child sleep problems	*"...my husband and I have talked about trying to minimize the tension and keep it as calm as possible and that definitely helps...* [child's sleep problems]*"*

Codes	Data
Onset of child's aggressive behaviour following-parental conflict	*"...* [child] *didn't really have the anger issues then* [post-earthquakes] *... I think that's more to do with...* [parental conflict] *..."*
Earthquake compounded existing stressors and caused long-term difficulties	*"The earthquake just escalates your problems, just multiplies them".*
Earthquake negatively impacted parental wellbeing and family atmosphere	*"There's a lot of negativity, there's a lot of anger and frustration in the house now* [since the earthquake]*".*
Maternal stress and frustration due to sudden destruction and closure of community resources	*"...* [it was] *frustrating, like the lack of facilities and amenities and scary and disheartening..."*
Earthquake effects on peers' influenced child's anxiety	*"...I know that a lot of her friends had pretty high anxiety around it* [earthquakes]*...so that could also affect how she's feeling about it..."*
Previous difficulties with peers due to child's emotional outbursts	*"...not fitting in, not having friends, probably because of her behaviour".*
Previous bullying impacted child's sleep and behaviour problems	*"*[When child was being bullied] *he wet the bed more...and his behaviour...he'd get angry..."*
Mass media provokes maternal anxiety by communicating the possibility of future earthquakes	*"...I do read articles* [about earthquake risk] *knowing that I shouldn't so that can definitely bring it back..."*
Upcoming storm reports trigger child anxiety and prompt room sharing	*"...if there's bad weather or things, which I guess is from watching the news and stuff and she knows there's going to be weather she likes to* [room-share] *..."*
Greater flexibility of buildings trigger child physiological response	*"...he'll jump thinking there's a big one coming even when a truck goes past it'll shake our house..."*
Long-term financial hardship which obstructs access to services	*"...you get 6 sessions* [of mental health services] *free and then no one can afford to pay..."*
Parental engagement with support services improved parental wellbeing and mental health	*"...went to the doctor and said I need help and then had maybe I think six counselling sessions...and that really helped..."*

Codes	Data
Supportive school teachers alleviated maternal anxiety	*"…kindy* [teachers] *…were really supportive and …just talking and being there … and reassuring that the kids know what to do if there's an earthquake…"*
Child's smooth school transition related to supportive teachers	*"…* [child] *settled in straight away…she had an amazing, really nurturing teacher which may have been why* [child transitioned to school smoothly] *…"*
Improvement in behaviour problems associated with improved sleep	*"…*[improvement] *with her behaviours and therefore her sleep".*

The Process of Organising Themes according to an Ecological-Transactional Framework

The quantity of themes extracted throughout content analysis can be partly explained by the diversity of participants' histories, experiences and complexities. This was also because themes needed to be categorised according to the various levels of the ecological-transactional model.

All themes described in Table 2 have been organised according to an ecological-transactional framework and are depicted in Table 4. The table is set up as a matrix, so themes are classified according to the ecology and level of risk they best fit into. The columns include the children's four ecologies (ontogenic, microsystem, exosystem and macrosystem). The rows represent the four levels of risk (enduring vulnerability factors, transient challengers, enduring protective factors and transient buffers), and therefore indicate whether the theme acted as a protective or risk factor for the families and the development of the children's sleep problems.

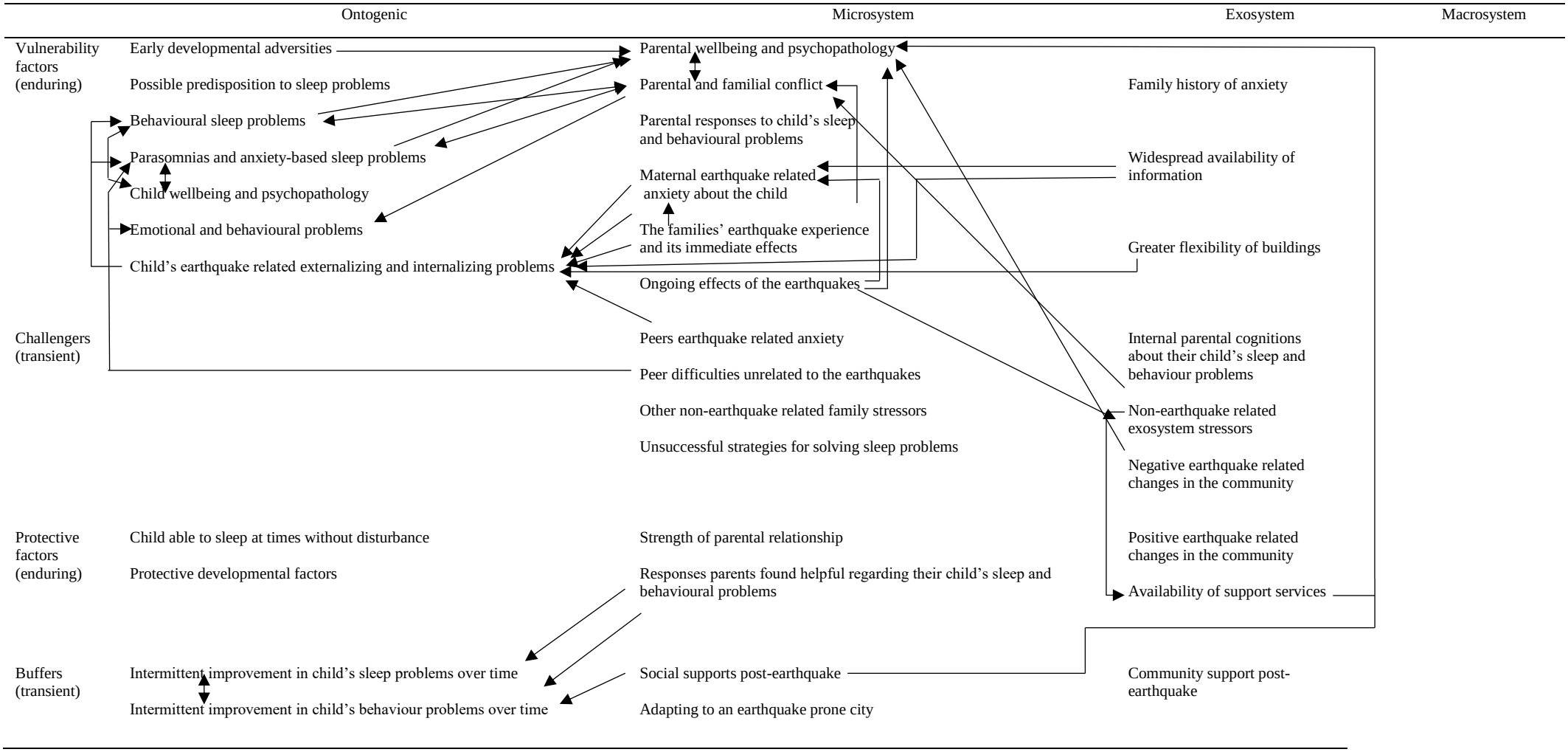
The direction of relationships between themes is illustrated using arrows. Those with a single arrow head portray a unidirectional relationship while a double arrow head portrays a bidirectional relationship. It must be noted that some arrows go across the levels of risk, for

example, a theme in the protective section with an arrow pointing to a theme in the enduring vulnerability section. This demonstrates that factors within the protective theme buffered the impact of factors within the enduring vulnerability theme, on the child and/or parents. This directly corresponds with codes in Table 3 which identify interactions between factors identified by the parents. For example, in using the same example as above: “maternal anxiety due to early developmental adversities” the relationship between these two factors is depicted on Table 4 with a single headed arrow pointing from the theme “early developmental adversities” to “parental psychology and wellbeing”, as this is where the code for maternal anxiety sits.

As this was a qualitative study, relationships between themes were only identified according to what parents themselves recognised and described as interactions between the various factors (Table 3). This is why there are no macrosystem themes as no factors relating the macrosystem were identified by participants.

Table 4

An Ecological-Transactional Framework including themes and interactions from interviewees experiences of children's sleep problems in the context of the earthquakes



Summary

The quantity of themes and codes help to demonstrate how complicated a task it is to identify all the factors which have taken place in the participants lives, both pre- and post-earthquakes, which have contributed to the development and/or deterioration of the children's sleep problems and led these families to their current situation. In addition, this chapter purposefully withholds a full explanation and only identifies the relationships between themes through the use of arrows on Table 4 as well as the codes on Table 3 which depict interactions between factors from different themes. The following chapter discusses factors in the tables above by completing an analysis of the factors contributing to the children's sleep problems, as well as what factors may have helped protect the child and family from enduring vulnerabilities or transient challengers. This analysis will address key factors and the relationships between them as described by parents which will then be grounded and explained according to the literature.

Chapter 5

Analysis and Discussion of the Literature: Clinical Reasoning and Ecological Analysis

The following section continues directly on from the results chapter where codes and related themes elicited through the process of content analysis were depicted, and themes were organised according to an ecological-transactional framework. These themes indicated a number of dynamic and static factors. These are likely to have contributed to the onset and perpetuation of the children's sleep problems and these families' current situation. The following section will take the factors identified by parents in relation to the children's sleep problems and the families' earthquake experiences and will pull these together in an analysis using clinical reasoning. These factors will be discussed in relation to the literature. The following analysis will begin with an outline and then the contributing factors will be discussed under the appropriate headings, depicted in Table 1. Although, some heading choices may seem arbitrary. This simply reflects the difficulty in categorizing some factors. This is because the analysis is based on both formulation and an ecological-transactional framework. This presented some difficulties, particularly in differentiating between precipitating and perpetuating factors related to the earthquakes. For example, the earthquakes may be considered a precipitating factor, or they may be considered a perpetuating factor because of the longevity of the active earthquake period. In the current analysis the duality of the earthquakes has been considered. As such, the earthquakes are categorized as a precipitating factor with enduring consequences.

A Clinical Reasoning Analysis of Factors Contributing to the Children's Sleep Problems in Relation to the Earthquakes and other Factors

Overview. The analysis is of the factors identified by parents across four families. It will draw on aspects from multiple systemic formulation frameworks, typically applying to individual children and their family including Havighurst and Downey's (2009) and Connor and Fisher's (1997) frameworks. These are beneficial when trying to understand complex cases and so are applicable to the current analysis due to the number of factors identified which must be tied together. These frameworks helped provide structure to the clinical reasoning process and analysis by prioritizing information and highlighting relationships. This is done through the use of Havighurst and Downey's (2009) predisposing, precipitating, perpetuating and protective factors, as well as by drawing on Connor and Fisher's (1997) constructs of circularity. This helps to explain interactions between family members and patterns of behaviour which may have inadvertently helped maintain the current sleep problems. This analysis also draws on Cicchetti et al.'s (2000) ecological-transactional framework, originally utilised to organise the factors identified by the literature as affecting child maltreatment. This framework helped identify which factors are likely to have had the most influence on the child's development, including the development of sleep problems, depending on how proximal the factors were within the child's ecology. These are prioritized using this framework which is beneficial for this study considering the influence children and parents have on the development of sleep problems. Factors within more proximal ecologies are therefore given more weight in this analysis compared to factors in the outer ecologies. This framework has adapted the ecological-transactional model in a manner which is appropriate for psychological variables and is compatible with the reasoning used here. Information in the current analysis is based on the reports of one father and four mothers.

In the current study, all parents described an onset or drastic deterioration of sleep related problems across children around the time of the Christchurch and/or Kaikoura earthquakes. The major factors contributing to the analysis included both dynamic and static factors. Dynamic factors, such as maternal and child anxiety; parental conflict, mental health and wellbeing; the child's emotional and behavioural problems, and parental responses to the children's sleep and behaviour problems appeared to play a key role in the perpetuation of sleep problems across families. Static factors such as the actual earthquake event, including the subsequent effects and the families' experiences; other family and external stressors, and a possible predisposition to sleep and anxiety related problems likely played an influential role in the development and maintenance of sleep problems. Protective factors in relation to the children's sleep problems and the effects of the earthquakes were also identified across families.

Children were reported to have a constellation of behaviours, some of which are likely related to post-traumatic stress. For example, behaviours such as a heightened startle response and strong physiological arousal after earthquakes, or earthquake reminders, were reported by parents and are consistent with the effects of trauma, matching on to PTSD criteria (American Psychiatric Association, 2013). However, some behaviours could be related to PTS but are possibly due to other behaviourally related factors, or other stressors in the children's life. This will be further discussed below. While all possible contributing factors must be considered, it is often too complex to disentangle the exact cause and to be able to accurately demonstrate that some of the children's behaviours are purely related to PTS.

Precipitating/Enduring Factors. The Christchurch earthquakes acted as a precipitating factor with enduring consequences. Therefore, this section includes a mix of precipitating and perpetuating earthquake related factors, which are discussed in relation to each other due to the difficulty in disentangling them. Factors discussed include the families'

earthquake experiences, including immediate and ongoing effects; parental responses to the earthquakes; and how the children's presentation may be related to these events, including the possible biological impact.

The earthquakes and subsequent aftershocks were described by all parents as highly stressful experiences. Most parents also described the children as experiencing high levels of distress during this period, including fear of dying. Some families, including the children, were immediately exposed to destruction due to their location during the earthquakes. Some parents also reported difficulties through exposure to secondary stressors such as damage to property and possessions, closure of community resources and facilities, and a temporary loss of power.

Exposure to so many earthquakes and aftershocks over a prolonged period may have led to trauma due to the level of stress the earthquakes caused. It could be that the possible trauma of experiencing such a stressful event has contributed to the children's current sleep problems. For example, some parents reported that children experienced a strong physiological response and heightened startle response in the face of earthquakes and earthquake reminders, such as the shaking of buildings. These are likely due PTS symptoms from the earthquakes as they are consistent with diagnostic criteria for PTSD. Children's subjective experiences during the earthquakes would likely be influential in the development of behaviours consistent with PTS symptoms. For some children, their high level of distress, including fear of dying as reported by some parents may have contributed to the development of PTS symptoms. This could have then contributed to an elevated state of arousal that impacted the children's sleep. This is consistent with the literature which has shown that the level of experienced distress and perceived life threat predict PTS symptoms in children (Furr et al., 2010). There are also aspects of the disaster and subsequent secondary stressors which could have influenced the development of the children's sleep problems. For example, some

participants experienced damage to the home which has been found to be associated with shorter sleep duration following a disaster (Usami et al, 2013), while continued house disrepair, also experienced by some participants, has been associated with greater severity of sleep disturbance and fear of sleeping alone (Brown et al, 2011).

Sleep problems reported by parents such as delayed sleep onset because of an inability to relax, and night-waking, may be due to hyperarousal, which is a symptom of PTSD. Hyperarousal may also account for angry outbursts due to increased irritability (American Psychiatric Association, 2013), which could partly explain some of the children's emotional and behavioural problems. However, the relationship is complex and absolute conclusions cannot be drawn. For example, delayed sleep onset and night-waking could be because of behavioural factors, for example, association of the parent with sleep onset. Likewise, delayed sleep onset may be because of other factors such as worry or anxiety unrelated to the earthquakes. Or these sleep problems may be due to numerous factors in addition to PTS. Furthermore, while the child's angry outbursts may be due to hyperarousal, it is also likely that they could be from other negative life events and parental conflict which will be discussed in further on.

Parents also reported that children experienced anxiety and a strong physiological response to storms and strong winds, which begun post-earthquake. This is likely a generalized fear response which is common in children following natural disasters, including earthquakes (Dogan-Ates, 2010). Anecdotal reports also demonstrate that fears of strong winds and storms are common in children exposed to the Christchurch earthquakes (Dunbar, 2013; Stewart, 2016). In addition, parents reported that children experienced numerous fears. These included being afraid being alone and of the dark. These fears are possibly related to the earthquakes, as they have been reported after earthquakes in children (Karairmak & Aydin, 2008; Terr, 1991). Furthermore, these are not normal developmental fears for this age

group of children (Carr, 2015). Additionally, the timing of the first September earthquake in the early hours of the morning may have contributed to the children's ongoing fear of the dark due to association of the earthquake with developmentally normal night-time fears, i.e. fear of the dark (Karairmak & Aydin, 2008).

Behaviours identified by parents may also be explained through biological changes in the brain. This can occur due to exposure to chronic stress from the earthquakes at an early age. For those children who experienced the Christchurch earthquakes and thousands of aftershocks, the duration of exposure is particularly relevant as it makes this a Type II trauma. This can result in problems associated with chronic levels of stress (Liberty, 2017; Shaw, 2000), including a range of developmental, emotional, and behavioural problems (Shaw, 2000). Furthermore, research has shown that trauma and exposure to chronic levels of stress at an early age can have potentially permanent negative impacts on brain development, such as dysregulation and sensitization of children's major stress systems. This includes the sympathetic nervous system (SNS) and the serotonin system (De Bellis & Zisk, 2014). Such changes could account for some of the children's behaviours which are consistent with PTSD criteria, for example, the heightened startle response and strong physiological response to earthquakes and earthquake reminders. This is because the child's fight, flight and freeze response has been primed to 'hyper'-respond when experiencing acute stress or traumatic reminders (De Bellis & Zisk, 2014). Disruptions to the serotonin system could also partially account for the children's emotional and behavioural problems as it may impact their ability to self-regulate. Furthermore, it could have made these children more vulnerable to anxiety. This is relevant as some of these children have been reported to have a high number of worries as well as difficulties regulating anxiety (De Bellis & Zisk, 2014; Ressler & Nemeroff, 2000).

These changes could therefore be impacting the children's sleep problems such as bed-time resistance and associated aggressive behaviours. It may also be affecting sleep onset and night-waking. This is because if the child is on high alert and vigilant as a result of repeated activation of stress response systems, then they may struggle to relax and disengage enough from the outside environment in order for sleep onset to occur. Such a state of alertness would directly inhibit sleep. In addition, chronic levels of stress can lead to PTS symptoms (Liberty, 2017), which may also partially explain some of the children's presenting difficulties. While this is a possibility, the complexity makes it difficult to draw concrete explanations. For example, some children were reported to have experienced other family related stressors which may have contributed to sleep problems. Negative life events following a natural disaster have been found to contribute to the persistence of sleep problems (Geng et al., 2013). Other stressors may have also contributed to the children's emotional and behavioural problems. These will be discussed further on.

While the Christchurch and/or Kaikoura earthquakes acted as a precipitating factor for the development and deterioration of these children's sleep problems, one of the major factors that is likely to have contributed to children's post-earthquake adjustment and subsequent sleep problems is the parents' response and adjustment to the earthquakes. This is because the participants in the current study were aged 3 to 4 years when the earthquakes started. Young children tend to rely on social referencing to parents and caregivers to assess the level of safety and risk due to limited cognitive awareness and understanding of highly stressful and potentially traumatising events such as disasters (Shaw, 2000). Therefore, parental emotions, attitudes and behaviours communicate to the child whether they are safe or in danger, which therefore influences the children's reactions following a disaster (Shaw, 2000). While parents' reactions in the current study varied, one pronounced factor was the impact the earthquakes had on the parents' psychopathology, and immediate and ongoing

wellbeing. This includes the level of emotional distress and anxiety some parents understandably experienced during the earthquakes and in the immediate aftermath. For some families, the earthquake prompted immediate co-sleeping and room-sharing. This was so parents could remain close to the children in order to provide protection from ongoing earthquakes if needed, as well as to help settle and alleviate the children's anxiety. However, for some children, parents reported that this meant they directly witnessed their parents distress after subsequent aftershocks.

Parental responses, anxiety and distress may have possibly communicated to the children an inflated sense of danger and overprotectiveness. This may have inadvertently reinforced and exacerbated the children's own earthquake related internalizing and externalizing problems, including their immediate anxiety and distress, and subsequent sleep problems. This is consistent with the literature which has demonstrated that parental distress can exacerbate the overall impact of the disaster on children and is therefore fundamental in terms of the child's adaptation and recovery (Dyb, Jensen, & Nygaard, 2011). The parents distress may have also contributed to the development of sleep problems by increasing the child's fear, which has previously been associated with PTS following an earthquake (Kiliç, Kiliç, & Aydin, 2011). Specifically, anxiety related to the earthquake could have directly contributed to the development and maintenance of sleep problems as anxiety is a state of increased arousal and vigilance and is therefore incompatible with sleep (Dahl & El-Sheikh, 2007; Peterman et al., 2015). Furthermore, parental overprotectiveness has been associated with children's PTS symptoms (Cobham & McDermott, 2014). This is also in accordance with the anxiety literature, which has demonstrated that parental overprotectiveness is associated with anxiety disorders in children (Rapee, 2012). However, it must be acknowledged that the participants' experiences of distress, anxiety and fear during and immediately following the earthquakes is a completely normal and even adaptive response in

the face of a potentially life-threatening situation as the purpose of this acute stress, i.e. physiological arousal related to the fight, flight and freeze response is to preserve life (Kendall-Tackett, 2000; Shaw et al., 2012).

Some parents reported that at the time of the earthquakes they believed that their child would be protected from any long-term consequences of the earthquakes due to their age. Therefore, the parents focus was on the children's physical safety. This is not wholly surprising as prior to the 1970s it was commonly believed children's post-disaster reactions only encompassed transient distress (Alisic, 2011). Furthermore, parents reported not only having to deal with their children's reactions to the earthquakes and aftershocks, but also their own strong emotional reactions and numerous secondary stressors, including damage to the home, possessions and loss of power. It is therefore possible that parental resources were stretched, and in combination with parental cognitions about the child's age at the time of the earthquakes being a protective factor, children's emotional wellbeing and distress may have been inadvertently overlooked. This is not uncommon following a natural disaster (Silverman & La Greca, 2002), and may have contributed to the children's ongoing problems relating to the earthquakes.

Predisposing/Enduring Factors. There are numerous static or unchangeable factors which may have predisposed these children to developing sleep problems. These include a history of sleep difficulties, a difficult temperament, developmental adversities, parental psychopathology and lack of wellbeing, and a family history of anxiety and nocturnal enuresis.

A history of early sleep difficulties in infancy and early childhood could suggest those children were more vulnerable to experiencing sleep problems. This may have also increased their risk for negative post-disaster outcomes. This is because the presence of sleep problems

prior to traumatic event exposure can contribute to poorer adjustment following the traumatic event (Germain, 2013). In addition, some children were described as having a difficult temperament which is a risk factor for the development of sleep problems as it means these children may find it more difficult to use self-soothing techniques to regulate arousal (Carr, 2015). There were also some early developmental adversities experienced within this group of children which may have contributed to the development of sleep problems. For example, premature birth was reported, and is a risk factor for future development of ADHD, which was a co-existing problem for some children (Thapar, Cooper, Eyre, & Langley, 2013). Children with ADHD are at a greater risk for the development of sleep problems, including bed-time resistance and circadian rhythm sleep-wake disorders, which could account for some of the erratic sleep patterns reported in this study for some children (Cortese et al., 2013; Sciberras, Song, Mulraney, Schuster, & Hiscock, 2017). Low cognitive ability was also reported by parents. This may have influenced those children's immediate and ongoing response to the earthquakes. Low cognitive ability may have made the earthquakes more confusing and frightening, as cognitive development is essential in making sense of potentially traumatic events (Dogan-Ates, 2010; Shaw et al., 2012).

For those children who had early developmental adversities, parents reported this placed stress on the family, particularly the mothers. For some, this contributed to maternal anxiety during pregnancy and the children's early years. Parental psychopathology and lack of wellbeing were reported across some families pre- and post-earthquakes. Parental psychopathology refers to diagnoseable mental health problems, including maternal anxiety and bipolar disorder and parental depression. Other factors such as maternal low mood and parental stress, as reported by parents, impacted parents' wellbeing. While it is difficult to ascertain the relative contributions of the earthquakes and these other factors, studies have indicated that parental psychopathology, such as maternal anxiety, depression and bipolar

disorder are associated with increased risk of children's sleep problems (O'Connor et al., 2007; Sadeh, Tikotzky, & Scher, 2010; Stoléru, Nottelmann, Belmont, & Ronsaville, 1997). While parental psychopathology and lack of wellbeing may act as an enduring risk factor for the development of sleep problems, it may be that those children would have developed sleep problems regardless of parental mental health, simply due to the highly stressful nature of the earthquakes.

The sleep presentations of some children may also have been exacerbated by a family history of anxiety. Those children may have been genetically vulnerable to experiencing anxiety related problems, including disturbed sleep (Alfano et al., 2010; Carr, 2015). For example, anxious children commonly experience delayed sleep onset, nightmares and difficulty sleeping alone (Alfano, Ginsburg, & Kingery, 2007). These were sleep problems which were reported in some of the children. Parents reported delayed sleep onset occurring post-earthquake while the onset of nightmares and difficulty sleeping alone varied across participants, with some reported to have experienced these difficulties both pre- and post-earthquake. Three of the four participants were also described as having problems with anxiety according to maternal report. In addition, nocturnal enuresis was reported to have emerged post-earthquakes. However, it cannot be concluded that the earthquakes led to the onset of nocturnal enuresis due to the child's age, as well as a family history of nocturnal enuresis. Specifically, nocturnal enuresis is not diagnosed prior to five years of age because bed-wetting is still normative at this age (American Psychological Association, 2013; Carr, 2015). Furthermore, enuresis can be classified as either primary or secondary, with primary enuresis being caused by a genetic component, while secondary enuresis is caused by stress, such as that brought on by experiencing a natural disaster (Carr, 2015). The child's age at the onset of nocturnal enuresis, as well as the family history of maternal nocturnal enuresis make it impossible to conclude whether its onset was due to a genetic component or experiencing

the earthquakes. While these predisposing factors cannot be changed, their impact may be alleviated due to other protective factors and adaptive strategies.

Perpetuating/Enduring factors. There are numerous enduring factors both in the microsystem and exosystem across families that have contributed to the perpetuation of the current sleep problems. These include parental wellbeing, for example, stress and fatigue; and parental psychopathology, for example, anxiety and depression; parental conflict; and parental strategies, responses and intrinsic cognitions relating to the children's sleep and behaviour problems. Specific ontogenic factors include the children's wellbeing and psychopathology, emotional and behavioural problems and the children's earthquake related externalizing and internalizing problems. Specific perpetuating earthquake related factors include negative earthquake related changes in the community, greater flexibility of buildings and the impact of the media on earthquake related problems.

Some of the current sleep problems may be inadvertently maintained through parent-child interactions. For example, for some families, co-sleeping and room-sharing began as a reactive parental response to cope with not only their own anxiety but their child's anxiety following the earthquakes. However, co-sleeping and room-sharing have been reported by some parents as post-earthquake. Part of this may be behavioural, i.e. from consistent reinforcement, which may also explain the children's curtain call. However, anxiety may also be playing a role. One theoretical mechanism which has been proposed as relating to sleep problems in anxious children is parental accommodation. This refers to permitting avoidance behaviour or facilitating anxious behaviours such as reassurance seeking (Lebowitz, Scharfstein, & Jones, 2014; Peterman et al., 2015). Co-sleeping is a common example of sleep-related accommodation and is a frequent sleep related problem in anxious children (Alfano et al., 2007). In addition, such strategies may inadvertently reinforce the children's

anxiety, therefore contributing to the persistence of sleep problems (Peterman et al., 2015; Sadeh, 2005).

Consistent with the literature, co-sleeping appeared related to other sleep problems such as bed-time resistance and night-waking (Jenni, Fuhrer, Iglowstein, Molinari, & Largo, 2005; Peterman et al., 2015). For example, upon night-waking after a nightmare, some parents reported that their child would seek them out to relieve their distress. Parents accommodated this need by reassuring the child or allowing co-sleeping. This pattern of behaviour between parent and child can be explained with the escape and avoidance model of anxiety. In this case these children have escaped feelings of anxiety brought on by a nightmare by seeking out a parent who then provided reassurance which relieved the child's anxiety. However, escape behaviour can help maintain the anxiety (Salkovskis, 1991) as it provides negative reinforcement, therefore increasing the chances of the child seeking out the parents in future to relieve anxiety (Alfano et al., 2007; Carr, 2015). In this way, anxiety related sleep problems such as co-sleeping and room-sharing have been maintained. Additionally, having a parent present at sleep onset likely means that the children have come to rely on this association to fall asleep, and so upon night-waking they need to re-establish contact with the parent to fall asleep (K. F. Davis et al., 2004), thereby perpetuating the problem.

Parents reported attempting to implement limits, for example, by limiting co-sleeping. However, children tended to react negatively with uncompliant, oppositional and aggressive behaviour associated with bed-time resistance. The parents then relented and allowed co-sleeping. This not only reinforces the sleep problems but also the associated behaviour problems. However, the parents' ability to set effective limits would have been strongly challenged due to the children's emotional and behavioural problems. Furthermore, because

these patterns of behaviour have become so entrenched over the years, those children were possibly more likely to react negatively and become oppositional when limits were imposed.

Furthermore, sleep loss caused by the children's sleep problems impacted both the children's and parents' wellbeing by causing fatigue. For the children this tended to exacerbate behaviour problems, possibly due to a reduced capacity to self-regulate (Dahl, 1996). Parental fatigue helped perpetuate sleep problems as it impacted the parents' ability to implement successful sleep strategies and contributed to the use of ineffective strategies inconsistent with appropriate sleep hygiene practises. It also appeared to contribute to more emotionally reactive parental responses to the children's sleep problems and tended in turn to exacerbate bed-time resistance and associated aggressive and oppositional behaviour. Parents then tended to relent to this, therefore beginning the cycle anew. This is an example of a coercive cycle where the parents' reactive response led to an escalation in the children's behaviour. The parents then backed down, therefore reinforcing the aggressive and oppositional behaviour (Granic & Patterson, 2006). Additionally, the children's existing emotional and behavioural problems were reported to add more stress to the family, further impacting the parents' wellbeing and their ability to then manage the sleep problems effectively. This is consistent with the research which has shown that both children with sleep problems and their parents typically demonstrate emotional dysregulation due to chronic sleep loss (Carr, 2015; Yoo, Gujar, Hu, Jolesz, & Walker, 2007). Parental cognitions may have also influenced their responses to the children's sleep problems. For example, due to their longevity, many parents saw them as inherent to the child and doubted the child's ability to sleep without disturbance. This may have impacted parental motivation and self-efficacy around solving their child's sleep problems.

For some families, the children's sleep problems, particularly bed-time resistance and associated co-sleeping, was reported to contribute to parental conflict owing to disagreement

on how to manage these behaviours. Increases in parental conflict associated with children's sleep problems has been reported in the literature and is not unexpected owing to the amount of stress a child's sleeping problems can place on the family system (Carr, 2015; Kelly & El-Sheikh, 2011). Parental conflict was reported to be a significant factor for multiple families. This likely exacerbated and helped maintain sleep problems (Kelly & El-Sheikh, 2011) while a calm home environment was conducive to sleep. There are multiple mechanisms whereby parental conflict may have exacerbated the children's sleep problems. Firstly, for some children parental conflict reportedly contributed to anxiety, which then exacerbated sleep problems. This is likely as parental conflict can lead to anxiety and hypervigilance, therefore directly impeding sleep owing to increased arousal. Additionally, parental conflict can lead to anger in children which may have exacerbated bed-time resistance and overall aggressive and oppositional behaviour (Cummings & Davies, 2002; El-Sheikh, Buckhalt, Mark Cummings, & Keller, 2007). Furthermore, if these children are automatically primed to hyper-respond in the face of stress or threats due to early biological impacts on brain development from chronic stress, then these children may have been more readily sent into a state of vigilance from stress from parental conflict. This may have directly impeded sleep and contributed to more dysregulated emotional and behavioural problems during periods of parental conflict.

As stated above, the children's sleep and behaviour problems were reported to have an impact on parental wellbeing by contributing to fatigue and stress levels. Parental fatigue and stress likely contributed to conflict as it may have impacted the ability of some parents to regulate their emotions. Patterns of circulatory are demonstrated here with the children's sleep problems contributing to parental conflict, and stress and fatigue which may have contributed to parental conflict, which only exacerbated the child's sleep problems. Also, in accordance with Bandura's Social Learning Theory (1978), parental conflict may have

inadvertently led to modelling of antisocial behaviour, thereby contributing to behavioural problems such as aggression which could have contributed to bed-time resistance.

As mentioned above, one of the major impacts the earthquakes had on these families was the negative effect on parental wellbeing and psychopathology, both in the short and long-term. For example, the earthquakes themselves directly impacted parental psychopathology by increasing anxiety to a degree which some parents struggled to cope with. Furthermore, some families also dealt with secondary stressors such as ongoing practical difficulties including delays in home repairs as well as the negative impacts on the community. These impacted the parents' wellbeing by increasing stress, which may have then inhibited their ability to effectively deal with the children's earthquake related difficulties. This is consistent with research showing that secondary stressors can challenge one's ability to adapt and cope with their situation (Shaw et al., 2012; Silverman & La Greca, 2002) Additionally, ongoing stress and anxiety from the earthquakes for some, has naturally impacted on the parental relationship and exacerbated existing conflict, therefore also possibly contributing to the child's sleep problems.

Exosystem factors were also reported to have contributed to ongoing child and maternal earthquake related anxiety. For example, media communicated to parents the possibility of future earthquake threats and portrayed earthquake reminders. This led to maternal distress and anxiety and may therefore have inadvertently helped maintain the children's earthquake related anxiety. The media also directly impacted those children's earthquake- related anxiety around storms and strong winds by reporting on upcoming weather. This was identified in parental reports as a sensitizer to child earthquake anxiety. This then prompted room-sharing which was reinforced by the parents. Some children also experienced ongoing anxiety around building movement. This was demonstrated by a heightened startle response, as reported by parents, and shows the direct and ongoing effects

of the earthquakes. This response is likely due to the fact that the building movement mimics the feel of an earthquake, therefore providing a vivid reminder of the disaster and triggering an automatic fear response.

Perpetuating/Transient Factors. Unlike the above factors, the following are all transient meaning they added stress on the family system and posed a risk factor for the perpetuation of sleep problems and other difficulties for a brief period. Specific perpetuating factors relating to the earthquakes included earthquake related peer anxiety, while non-earthquake related factors included bullying, and family and exosystem stressors.

Some parents reported that many of the children's peers were severely affected by the earthquakes, and experienced high levels of anxiety. Parents thought this may have influenced their child's own anxieties and fears. Knowledge relating to the influence of peers in a disaster context is limited (Noffsinger et al., 2012) but it may be that anxiety was partly maintained or exacerbated through social contagion (Schwartz-Mette & Rose, 2012). Previous bullying, unrelated to the earthquakes was also reported. According to parent report, this directly exacerbated nocturnal enuresis and anxiety. This then exacerbated sleep problems, for example, through night-waking and delayed sleep onset respectively. This is consistent with research showing that acute life stress, including bullying is associated with nocturnal enuresis (Carr, 2015; Fekkes, Pijpers, Fredriks, Vogels, & Verloove-Vanhorick, 2006).

Other family stressors may have increased the child's anxiety and level of worries which may have then impacted sleep due to increased arousal (Alfano et al., 2010). External stressors included job loss and financial hardship. This impacted the parents' wellbeing by exacerbating stress levels and contributing to parental conflict, which then likely impacted the child's sleep as previously explained. A bidirectional relationship between parental

conflict and sleep problems was reported by some families. This is consistent with the literature demonstrating that marital conflict can predict increases in children's sleep problems, but that the children's sleep problems in turn also predicts marital conflict (Kelly & El-Sheikh, 2011). While these factors are all transient, their impact was reportedly amplified for some families because of ongoing stress from the earthquakes. This relates to the concept whereby exposure to numerous adversities and stressors do not make one stronger, but instead decrease and overextend the individual's resources, thereby impacting their ability to cope with new stressors (Thoits, 1995).

Enduring Protective Factors. Families identified numerous enduring protective factors which related to multiple levels of the child's ecology. These included children previously being able to sleep without disturbance, protective developmental factors, strength in the parental relationship, helpful parental responses, positive earthquake related changes and availability of support services.

Children were reported to have been able to sleep without disturbance at some point. This was due to numerous factors across families, including sleeping at another family members house, medication or natural remedies. This is fundamental as it means that these children are capable of performing the desired behaviour. Protective developmental factors included having a smooth early development, being able to form friendships and having a high cognitive ability. Being able to form friendships indicates good social skills which may enhance a child's resilience (Shaw et al., 2012), while intelligence is also considered an internal strength which can promote resilience in children and may have therefore have acted as a buffer, for some children, when exposed to the earthquakes (Alvord & Grados, 2005) Some parents also reported a strong marital relationship which may have acted as an important protective factor for some children. This is because when facing adversity, the opposite, i.e., a parental relationship with high levels of conflict, has been associated with

increased PTS symptoms in children following a natural disaster (Gewirtz, Forgatch, & Wieling, 2008; Wasserstein & La Greca, 1998). In addition, effective parental responses contributed to intermittent improvements in some children's sleep and behaviour problems, and some parents were also able to report lasting positive earthquake changes, which may be beneficial for parental wellbeing.

Transient Buffers. Transient buffers across families included improvement in the child's sleep and behaviour problems, social and community supports as well as some adaptation to earthquakes. Intermittent improvements in the children's sleep and behaviour problems, from parental responses, demonstrated that the children's sleep and behaviour problems are amenable to change. Families also addressed positive earthquake related factors such as community and social support which likely acted as a buffer to stress, protecting parental wellbeing by helping parents cope throughout the earthquake period. Across the families, social and community supports included neighbours, friends, extended family and teachers. It seemed to be the teachers in particular who played a vital role for some families as parents reported they helped alleviate maternal anxiety and assisted school transitions post-earthquake. Community and social supports such as these are invaluable following a disaster as strong social support networks contribute to resilience in children (Shaw et al., 2012), while disrupted social support can contribute to the persistence of maladaptive outcomes such as PTS symptoms (La Greca, Silverman, Lai, & Jaccard, 2010). Furthermore, by helping the parents cope following the disaster, community and social supports may have benefited the children, as parental functioning post-disaster has been shown to impact children's post-disaster outcomes (Green et al., 1991; Kiliç et al., 2011). Furthermore, some parents acknowledged a sort of adaptation to living in an earthquake prone city, where parents displayed stoicism, which possibly sheltered those children from the impact of the disaster. For example, in the literature asymptomatic parents following a natural disaster have been

shown to act as a buffer for the development of symptoms of distress (Dyb et al., 2011). Some parents also reported child adaptation in their ability to learn and utilize earthquake safety procedures. This relates to disaster preparedness which is considered an important avenue to reducing risk and increasing resilience as education can help communities in coping and adjusting to the impact of natural disaster such as earthquakes (Izadkhah & Hosseini, 2005; Ronan, Alisic, Towers, Johnson, & Johnston, 2015).

Summary

The above analysis effectively demonstrates how complex it can be to identify and pull apart what may be contributing to the child's current sleep problems. This is because of the myriad of factors involved, both related and unrelated to the earthquakes as well as the difficulty in differentiating between the effects of possible trauma and PTS and other contributing factors. However, the factors identified by parents and reflected in the subsequent analysis are consistent with the literature regarding children and family's post-disaster functioning. For example, one of the key factors was the impact the earthquakes had on parents' wellbeing and mental health and how this in turn impacted the parents' ability to cope which may have therefore impacted the child's post-disaster functioning. Parental mental health, as well as their responses to disaster have consistently been found to be an influencing factor in the child's adjustment (Green et al., 1991; Kiliç et al., 2011; Norris et al., 2002). However, this must be considered in light of the impact of the traumatic event on the child, including possible neurological effects (De Bellis & Zisk, 2014), as well as other individual characteristics of the child which have may influenced the impact of the earthquakes. The role of secondary stressors is also acknowledged as a contributing factor, demonstrating how the effects of a disaster are ongoing, even for years following the event as is the case with some of these families (Shaw et al., 2012). Likewise, additional stressors unrelated to the earthquakes and other negative life events are major contributing factors for

the current situation of some families. Protective factors such as social support, are also critical, particularly for their impact on parental mental health. Finally, this study demonstrated the long-term effects a natural disaster can have on child and family functioning. This includes the impact a child's sleep problems can have on the family by adding stress to an already stressful situation. Clearly these families, and likely others in similar situations, are in need of support due to the enduring effects of the earthquakes and other interacting factors which have inhibited the families' ability to cope and contributed to the child's current presentation.

Chapter 6

Discussion

The present study aimed to determine what ecological factors and transactions between them are identified by families as contributing to the children's presenting sleep problems. These factors, including transactions between them, have been identified through the process of content analysis in the context of clinical reasoning, and are reported in Tables 2-4. They will now be summarised briefly.

Enduring ontogenic vulnerability factors encompassed factors relating to the children's development that possibly contributed to the risk of the development of sleep problems. These included: early developmental adversities; a possible predisposition to sleep problems; problems detrimental to the child's wellbeing, for example, having a high level of worries; child psychopathology; emotional and behavioural problems; and earthquake related externalizing and internalizing problems. No transient ontogenic challengers were identified. Enduring microsystem vulnerability factors encompassed factors within the children's immediate environment which increased the risk for the development of sleep problems. These included: parental wellbeing and psychopathology, particularly maternal anxiety; parental conflict; parental responses to the child's sleep and behaviour problems; and the earthquakes, including their immediate and ongoing effects. Transient microsystem challengers encompassed brief stressors. These included: peers' earthquake related anxiety; peer difficulties unrelated to the earthquakes, i.e. bullying; other non-earthquake related family stressors; and unsuccessful strategies for solving sleep problems.

Enduring exosystem vulnerability factors encompassed factors in social settings that did not directly contain the children, but which may have increased the risk for the

development of sleep problems due to their impact on more proximal ecologies. These included: a family history of anxiety; the widespread availability of information, i.e. parents having access to information regarding future earthquake risk and the child having access to upcoming storm reports; and greater flexibility of buildings post-earthquake. Transient exosystem challengers included brief stressors. These included: internal parental cognitions relating to the child's presenting problems; non-earthquake related stressors; and negative earthquake related changes. Parents also identified a number of enduring protective factors and transient buffers which included: protective developmental factors; the child being able to sleep without disturbance at times; a strong parental relationship; responses which were found helpful regarding the child's sleep and behaviour problems and which contributed to their intermittent improvement; positive earthquake related changes; social and community supports; and adaptation, of both parents and children, to earthquakes. These findings are consistent with the literature, as discussed in the analysis.

The second aim of the study was to explore what a clinical reasoning analysis, based on the principles of formulation, could contribute to our understanding of possible mechanisms of effect for these families. One of the major benefits of utilizing a clinical reasoning analysis is that while the ecological-transactional framework helped identify factors and interactions between factors, it is the clinical reasoning analysis that helps guide the researcher towards possible coherent explanations of the phenomena. This included how factors have interacted with each other to contribute to the development or perpetuation of sleep problems in a disaster context. For example, other studies using an ecological model as an organising paradigm (e.g. Weems & Overstreet, 2000) do explain possible influences, but a clinical reasoning analysis contributed to a more cohesive understanding of the influences of factors across the child's ecologies. Therefore, the actual analysis in Chapter 5 answers

this question by explaining possible mechanisms of effect, in the context of clinical reasoning, while also being grounded in the relevant literature.

Clinical Implications

In addition, a clinical reasoning analysis helps to explain possible mechanisms of effect for these families by identifying static factors which have contributed to the children's current presentation, as well as dynamic factors. The dynamic factors are fundamental as it is here that recommendations can be made, and changes implemented. For example, these families could use support around parental conflict, stress management, as well as access to professional support around mental health problems. While some parents identified that this has helped in the past, access to services was reported to be difficult due to financial hardship. Additionally, support focusing on addressing the children's emotional and behavioural problems would be beneficial to the whole family, including the child. Other recommendations would include experienced support with implementation of behavioural interventions. While parents have described the use of behavioural strategies in the past, they were not found to be beneficial. It cannot be known if these were implemented correctly, however it may be that additional support is therefore needed. For families such as these who have been struggling with children's sleep problems for years, expertise help should be available. Although, some authors suggest that behavioural interventions may not be effective with children who have PTS symptoms. This could be due to the impact PTSD can have on neurological structures, such as the reward pathway, which may therefore affect the child's response to strategies which use behavioural methods (Liberty, 2017; Sailer et al., 2008). However, there is no research on the effectiveness of behavioural sleep interventions with children with PTS symptoms. Furthermore, PTSD is treatable so even if some symptoms did inhibit intervention, this could be addressed.

Strengths and Limitations

One of the major strengths of this study is that it utilized an original research approach by exploring the experiences of individual families in a disaster context using Cicchetti et al.'s (2000) ecological-transactional framework. This was originally used with data at the population rather than individual level. This was undertaken in conjunction with clinical reasoning, conducted in the light of information provided from the families, in an analysis based on the process of formulation. In using a qualitative approach to interviewing and the first phase of data analysis, the participants' thoughts regarding the causes of the presenting sleep problems were also captured. While data was pooled across families to ensure anonymity, basing the analysis on formulation was appropriate and legitimate as potential cause mechanisms were not mixed up between families. In utilizing an abductive approach, possible causal explanations around phenomena identified by parents could be determined. This study has also added to the literature regarding sleep problems in a disaster context as there is little qualitative research in this area.

One of the main limitations of this study was that not all children were able to be interviewed. This was an unavoidable limitation as it was the preference of some parents and children, while in one case external life events meant the child interview could not proceed as planned. As a result, for some families the information was primarily based on parent interviews and only corroborated by a questionnaire completed by the child. In one case, the only source of information was parental interviews, as external life events meant that additional data could not be collected. In regard to the information gathered, the lack of validation by the children is a limitation. Research shows that there is often disparity between parent and child reporting, with children typically reporting more sleep disturbance compared to their parents (Gregory et al., 2009; Gregory, Rijsdijk, & Eley, 2006). Likewise, only one family included the father in interviews while the other three families were only based off

maternal report meaning the fathers' perspectives were invisible and information from the mother could not be corroborated with the fathers' perspectives.

Lastly, only interactions and factors identified by parents were included on the ecological-transactional table. It was out of the scope of this thesis to describe interactions and relationships which parents did not explicitly state, but which may have possibly occurred all the same. Likewise, no macrosystem factors were identified by participants and as such were not included in the ecological-transactional table. However, macrosystem influences, such as demoralization around government response and specific structures (Noffsinger et al., 2012), for example, Earthquake Commission (EQC) may have been involved and actively influencing the participants' lives regardless. However, this may also demonstrate that parents place greater value on the impact of the factors within ecologies closer to the child and family and that macrosystem factors may not hold much weight for parents when considering other factors.

Future Research

Future research should try to bring in the father's perspective more, which was somewhat invisible in this study. This may create a better picture of the development and maintenance of sleep problems in a post-disaster context. There is also limited knowledge on the impact of peers in the development or maintenance of children's post-disaster reactions. This is an important avenue for future research, especially considering how much time children spend in the school setting alongside peers. Attention should also be given to behavioural sleep interventions in a post-disaster context. Specifically, would a typical sleep intervention work in a family with a child with PTS symptoms and possible changes in brain development due to the impacts of chronic stress? Or do sleep interventions need to be altered considering the research showing the neurological impacts of trauma?

Conclusion

In conclusion, this study determined ecological contextual factors identified by parents as contributing to the development of the child's sleep problems in a post-disaster context. In conducting an analysis grounded in clinical reasoning and the process of formulation, possible mechanisms of effect were identified. However, it is difficult to draw absolute conclusions regarding causal mechanisms due to the complexity. The number of factors involved for these families, both related and unrelated to the earthquakes demonstrate the complexity in determining the impact of such events and the development of sleep problems over such a prolonged period. Future research should focus on treatment and intervention of sleep problems in a post-disaster context, taking into consideration the impact of chronic stress and PTS symptoms on the brain.

References

Alexandru, G., Michikazu, S., Shimako, H., Xiaoli, C., Hitomi, K., Takashi, Y., . . . Sadanobu, K. (2006). Epidemiological aspects of self-reported sleep onset latency in Japanese junior high school children. *Journal of sleep research, 15*(3), 266-275.

Alfano, C. A., Ginsburg, G. S., & Kingery, J. N. (2007). Sleep-related problems among children and adolescents with anxiety disorders. *Journal of the American Academy of Child & Adolescent Psychiatry, 46*(2), 224-232.

Alfano, C. A., Pina, A. A., Zerr, A. A., & Villalta, I. K. (2010). Pre-sleep arousal and sleep problems of anxiety-disordered youth. *Child Psychiatry & Human Development, 41*(2), 156-167.

Alisic, E. (2011). *Children and trauma: a broad perspective on exposure and recovery*: Utrecht University.

Alvord, M. K., & Grados, J. J. (2005). Enhancing resilience in children: a proactive approach. *Professional Psychology: Research and Practice, 36*(3), 238.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*: American Psychiatric Pub.

Arendt, J. (2005). Melatonin: characteristics, concerns, and prospects. *Journal of Biological Rhythms, 20*(4), 291-303.

Babson, K. A., & Feldner, M. T. (2010). Temporal relations between sleep problems and both traumatic event exposure and PTSD: a critical review of the empirical literature. *Journal of Anxiety Disorders, 24*(1), 1-15.

Bandura, A. (1978). Social learning theory of aggression. *Journal of Communication, 28*(3), 12-29.

Bannister, S., & Gledhill, K. (2012). Evolution of the 2010–2012 Canterbury earthquake sequence. *New Zealand Journal of Geology and Geophysics, 55*(3), 295-304.

Bell, B. G., & Belsky, J. (2008). Parents, parenting, and children's sleep problems: exploring reciprocal effects. *British Journal of Developmental Psychology, 26*(4), 579-593.

Bernert, R. A., Merrill, K. A., Braithwaite, S. R., Van Orden, K. A., & Joiner Jr, T. E. (2007). Family life stress and insomnia symptoms in a prospective evaluation of young adults. *Journal of Family Psychology, 21*(1), 58.

Billows, M., Gradisar, M., Dohnt, H., Johnston, A., McCappin, S., & Hudson, J. (2009). Family disorganization, sleep hygiene, and adolescent sleep disturbance. *Journal of Clinical Child & Adolescent Psychology, 38*(5), 745-752.

Blampied, N. M. (2013). Functional behavioral analysis of sleep in infants and children. In A. Wolfson & H. Montgomery-Downs (Eds.), *The Oxford Handbook of Infant, Child, and Adolescent Sleep and Behavior* (pp. 169-188). New York: Oxford University Press.

Braun, V., & Clarke, V. (2013). *Successful qualitative research: a practical guide for beginners.* Retrieved from: http://eprints.uwe.ac.uk/21156/3/SQR%2520Chap%25201%2520Research%2520Repository.pdf

Breslau, N., Chase, G., & Anthony, J. (2002). The uniqueness of the DSM definition of post-traumatic stress disorder: implications for research. *Psychological Medicine, 32*(4), 573-576.

Bronfenbrenner, U. (1979). *The ecology of human development: experiments by nature and design*. Cambridge: Harvard University Press.

Carr, A. (2015). *The handbook of child and adolescent clinical psychology: a contextual approach* (3rd ed.). London and New York: Routledge.

Charuvastra, A., & Cloitre, M. (2009). Safe enough to sleep: sleep disruptions associated with trauma, posttraumatic stress, and anxiety in children and adolescents. *Child and Adolescent Psychiatric Clinics of North America, 18*(4), 877-891.

Chouw, N., & Hao, H. (2012). Pounding damage to buildings and bridges in the 22 February 2011 Christchurch earthquake. *International Journal of Protective Structures, 3*(2), 123-139.

Cicchetti, D., Toth, S. L., & Maughan, A. (2000). An ecological-transactional model of child maltreatment. *Handbook of Developmental Psychopathology, 2*, 689-722.

Cobham, V. E., & McDermott, B. (2014). Perceived parenting change and child posttraumatic stress following a natural disaster. *Journal of Child and Adolescent Psychopharmacology, 24*(1), 18-23.

Connor, D. F., & Fisher, S. G. (1997). An interactional model of child and adolescent mental health clinical case formulation. *Clinical Child Psychology and Psychiatry, 2*(3), 353-368.

Copeland, W. E., Keeler, G., Angold, A., & Costello, E. J. (2007). Traumatic events and posttraumatic stress in childhood. *Archives of General Psychiatry, 64*(5), 577-584.

Cortese, S., Brown, T. E., Corkum, P., Gruber, R., O'Brien, L. M., Stein, M., . . . Owens, J. (2013). Assessment and management of sleep problems in youths with attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 52*(8), 784-796.

Cox, R. C., Tuck, B. M., & Olatunji, B. O. (2017). Sleep Disturbance in Posttraumatic Stress Disorder: Epiphenomenon or Causal Factor? *Current Psychiatry Reports, 19*(4), 22.

Cummings, E. M., & Davies, P. T. (2002). Effects of marital conflict on children: recent advances and emerging themes in process-oriented research. *Journal of Child Psychology and Psychiatry, 43*(1), 31-63.

Dahl, R. E. (1996). *The impact of inadequate sleep on children's daytime cognitive function.* Paper presented at the Seminars in pediatric neurology.

Dahl, R. E., & El-Sheikh, M. (2007). Considering sleep in a family context: introduction to the special issue. *Journal of Family Psychology, 21*(1), 1.

Dai, W., Chen, L., Lai, Z., Li, Y., Wang, J., & Liu, A. (2016). The incidence of post-traumatic stress disorder among survivors after earthquakes: a systematic review and meta-analysis. *BMC Psychiatry, 16*(1), 188.

Davis, K. F., Parker, K. P., & Montgomery, G. L. (2004). Sleep in infants and young children: part two: common sleep problems. *Journal of Pediatric Health Care, 18*(3), 130-137.

Davis, L., & Siegel, L. J. (2000). Posttraumatic stress disorder in children and adolescents: A review and analysis. *Clinical Child and Family Psychology Review, 3*(3), 135-154.

De Bellis, M. D. (2001). Developmental traumatology: The psychobiological development of maltreated children and its implications for research, treatment, and policy. *Development and Psychopathology, 13*(03), 539-564.

De Bellis, M. D., & Zisk, A. (2014). The biological effects of childhood trauma. *Child and Adolescent Psychiatric Clinics of North America, 23*(2), 185-222.

De Young, A. C., Kenardy, J. A., & Cobham, V. E. (2011). Trauma in early childhood: A neglected population. *Clinical Child and Family Psychology Review, 14*(3), 231.

Dirkzwager, A. J., Kerssens, J. J., & Yzermans, C. J. (2006). Health problems in children and adolescents before and after a man-made disaster. *Journal of the American Academy of Child & Adolescent Psychiatry, 45*(1), 94-103.

Dogan-Ates, A. (2010). Developmental differences in children's and adolescents' post-disaster reactions. *Issues in Mental Health Nursing, 31*(7), 470-476.

Downe-Wamboldt, B. (1992). Content analysis: method, applications, and issues. *Health Care for Women International, 13*(3), 313-321.

Dunbar, J. (2013, December 5). Storms leave children quaking. *The Press.* Retrieved from: *http://www.stuff.co.nz/the-press/news/christchurch-earthquake-2011/9478050/Storms-leave-children-quaking*

Dyb, G., Jensen, T. K., & Nygaard, E. (2011). Children's and parents' posttraumatic stress reactions after the 2004 tsunami. *Clinical Child Psychology and Psychiatry, 16*(4), 621-634.

Edwards, R., & Holland, J. (2013). *What is qualitative interviewing?* London and New York: Bloomsbury.

El-Sheikh, M., Buckhalt, J. A., Mark Cummings, E., & Keller, P. (2007). Sleep disruptions and emotional insecurity are pathways of risk for children. *Journal of Child Psychology and Psychiatry, 48*(1), 88-96.

Elliott, R., Fischer, C. T., & Rennie, D. L. (1999). Evolving guidelines for publication of qualitative research studies in psychology and related fields. *British journal of clinical psychology, 38*(3), 215-229.

Elo, S., Kääriäinen, M., Kanste, O., Pölkki, T., Utriainen, K., & Kyngäs, H. (2014). Qualitative content analysis: A focus on trustworthiness. *Sage Open, 4*(1), 1-10.

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing, 62*(1), 107-115.

Esposito, M. J., Gnisci, A., Fabbri, M., & Cicogna, P. (2014). Sleep Duration in Italian Children: Parental Control on Bedtime as Explaining Factor. *Sleep and Hypnosis, 16*(1-2), 1-9.

Fan, F., Zhou, Y., & Liu, X. (2017). Sleep Disturbance Predicts Posttraumatic Stress Disorder and Depressive Symptoms: A Cohort Study of Chinese Adolescents. *The Journal of Clinical Psychiatry, 78*(7), 882-888.

Fekkes, M., Pijpers, F. I., Fredriks, A. M., Vogels, T., & Verloove-Vanhorick, S. P. (2006). Do bullied children get ill, or do ill children get bullied? A prospective cohort study on the relationship between bullying and health-related symptoms. *Pediatrics, 117*(5), 1568-1574.

Fernández-Mendoza, J., Vela-Bueno, A., Vgontzas, A. N., Ramos-Platón, M. J., Olavarrieta-Bernardino, S., Bixler, E. O., & De la Cruz-Troca, J. J. (2010). Cognitive-emotional hyperarousal as a premorbid characteristic of individuals vulnerable to insomnia. *Psychosomatic Medicine, 72*(4), 397-403.

Ford, D., Pat-Horenczyk, R., & Brom, D. (2009). Treating traumatized children. Risk, resilience, and recovery. In E. Alisic (Ed.), *Children and trauma: a broad perspective on exposure and recovery*. Utrecht University.

Furr, J. M., Comer, J. S., Edmunds, J. M., & Kendall, P. C. (2010). Disasters and youth: a meta-analytic examination of posttraumatic stress. *Journal of Consulting and Clinical Psychology, 78*(6), 765-780.

Galea, S., Nandi, A., & Vlahov, D. (2005). The epidemiology of post-traumatic stress disorder after disasters. *Epidemiologic Reviews, 27*(1), 78-91.

Galland, B. C., & Mitchell, E. A. (2010). Helping children sleep. *Archives of Disease in Childhood, 95*(10), 850-853.

Garrison, M. M., Liekweg, K., & Christakis, D. A. (2011). Media use and child sleep: the impact of content, timing, and environment. *Pediatrics, 128*(1), 29-35.

Germain, A. (2013). Sleep disturbances as the hallmark of PTSD: where are we now? *American Journal of Psychiatry, 170*(4), 372-382.

Gewirtz, A., Forgatch, M., & Wieling, E. (2008). Parenting practices as potential mechanisms for child adjustment following mass trauma. *Journal of Marital and Family Therapy, 34*(2), 177-192.

Gledhill, K., Ristau, J., Reyners, M., Fry, B., & Holden, C. (2011). The Darfield (Canterbury, New Zealand) Mw 7.1 earthquake of September 2010: a preliminary seismological report. *Seismological Research Letters, 82*(3), 378-386.

Goenjian, A. K., Pynoos, R. S., Steinberg, A. M., Najarian, L. M., Asarnow, J. R., Karayan, I., . . . Fairbanks, L. A. (1995). Psychiatric comorbidity in children after the 1988: earthquake in Armenia. *Journal of the American Academy of Child & Adolescent Psychiatry, 34*(9), 1174-1184.

Gökçen, C., Şahingöz, M., & Annagür, B. B. (2013). Does a non-destructive earthquake cause posttraumatic stress disorder? A cross-sectional study. *European Child & Adolescent Psychiatry, 22*(5), 295-299.

Graneheim, U. H., & Lundman, B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today, 24*(2), 105-112.

Granic, I., & Patterson, G. R. (2006). Toward a comprehensive model of antisocial development: A dynamic systems approach. *Psychological Review, 113*(1), 101.

Green, B. L., Korol, M., Grace, M. C., Vary, M. G., Leonard, A. C., Gleser, G. C., & Smitson-Cohen, S. (1991). Children and disaster: Age, gender, and parental effects on PTSD symptoms. *Journal of the American Academy of Child & Adolescent Psychiatry, 30*(6), 945-951.

Gregory, A. M., Caspi, A., Moffitt, T. E., & Poulton, R. (2006). Family conflict in childhood: a predictor of later insomnia. *Sleep, 29*(8), 1063-1067.

Gregory, A. M., Cox, J., Crawford, M. R., Holland, J., & Haravey, A. G. (2009). Dysfunctional beliefs and attitudes about sleep in children. *Journal of Sleep Research, 18*(4), 422-426.

Gregory, A. M., & Eley, T. C. (2005). Sleep problems, anxiety and cognitive style in school-aged children. *Infant and Child Development, 14*(5), 435-444.

Gregory, A. M., Eley, T. C., O'Connor, T. G., Rijsdijk, F. V., & Plomin, R. (2005). Family influences on the association between sleep problems and anxiety in a large sample of pre-school aged twins. *Personality and Individual Differences, 39*(8), 1337-1348.

Gregory, A. M., & O'Connor, T. G. (2002). Sleep problems in childhood: a longitudinal study of developmental change and association with behavioral problems. *Journal of the American Academy of Child & Adolescent Psychiatry, 41*(8), 964-971.

Gregory, A. M., Rijsdijk, F. V., & Eley, T. C. (2006). A twin-study of sleep difficulties in school-aged children. *Child Development, 77*(6), 1668-1679.

Gregory, A. M., & Sadeh, A. (2012). Sleep, emotional and behavioral difficulties in children and adolescents. *Sleep Medicine Reviews, 16*(2), 129-136.

Gregory, A. M., Willis, T. A., Wiggs, L., & Harvey, A. G. (2008). Presleep arousal and sleep disturbances in children. *Sleep, 31*(12), 1745-1747.

Guha-Sapir, D., Hoyois, P., & Below, R. (2013). *Annual disaster statistical review 2012: The numbers and trends*. Brussels: Centre for the Research on the Epidemiology of Disasters.

Guha-Sapir, D., Hoyois, P., & Below, R. (2016). *Annual disaster statistical review 2012: The numbers and trends*. Brussels: Centre for the Research on the Epidemiology of Disasters

Harvey, A. G., Jones, C., & Schmidt, D. A. (2003). Sleep and posttraumatic stress disorder: a review. *Clinical Psychology Review, 23*(3), 377-407.

Hsieh, H.-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*(9), 1277-1288.

Iwadare, Y., Usami, M., Ushijima, H., Tanaka, T., Watanabe, K., Kodaira, M., . . . Saito, K. (2014). Changes in traumatic symptoms and sleep habits among junior high school students after the Great East Japan Earthquake and Tsunami. *Sleep and Biological Rhythms, 12*(1), 53-61.

Izadkhah, Y. O., & Hosseini, M. (2005). Towards resilient communities in developing countries through education of children for disaster preparedness. *International Journal of Emergency Management, 2*(3), 138-148.

Jenni, O. G., Fuhrer, H. Z., Iglowstein, I., Molinari, L., & Largo, R. H. (2005). A longitudinal study of bed sharing and sleep problems among Swiss children in the first 10 years of life. *Pediatrics, 115*(Supplement 1), 233-240.

Jia, Z., Shi, L., Duan, G., Liu, W., Pan, X., Chen, Y., & Tian, W. (2013). Traumatic experiences and mental health consequences among child survivors of the 2008 Sichuan earthquake: a community-based follow-up study. *BMC Public Health, 13*(1), 104.

Jin, C. S., Hanley, G. P., & Beaulieu, L. (2013). An individualized and comprehensive approach to treating sleep problems in young children. *Journal of Applied Behavior Analysis, 46*(1), 161-180.

Kahn, M., Sheppes, G., & Sadeh, A. (2013). Sleep and emotions: bidirectional links and underlying mechanisms. *International Journal of Psychophysiology, 89*(2), 218-228.

Kaiser, K. (2009). Protecting respondent confidentiality in qualitative research. *Qualitative Health Research, 19*(11), 1632-1641.

Karairmak, Ö., & Aydin, G. (2008). Brief Report: Reducing Earthquake-Related Fears in Victim and Nonvictim Children. *The Journal of Genetic Psychology, 169*(2), 177-186.

Kelly, R. J., & El-Sheikh, M. (2011). Marital conflict and children's sleep: reciprocal relations and socioeconomic effects. *Journal of Family Psychology, 25*(3), 412.

Kendall-Tackett, K. A. (2000). Physiological correlates of childhood abuse: chronic hyperarousal in PTSD, depression, and irritable bowel syndrome. *Child Abuse & Neglect, 24*(6), 799-810.

Kiliç, C., Kiliç, E. Z., & Aydin, I. O. (2011). Effect of relocation and parental psychopathology on earthquake survivor-children's mental health. *The Journal of Nervous and Mental Disease, 199*(5), 335-341.

Kondracki, N. L., Wellman, N. S., & Amundson, D. R. (2002). Content analysis: review of methods and their applications in nutrition education. *Journal of Nutrition Education and Behavior, 34*(4), 224-230.

Kovachy, B., O'Hara, R., Hawkins, N., Gershon, A., Primeau, M. M., Madej, J., & Carrion, V. (2013). Sleep disturbance in pediatric PTSD: current findings and future directions. *Journal of Clinical Sleep Medicine, 9*(5), 501-510.

La Greca, A. M., Silverman, W. K., Lai, B., & Jaccard, J. (2010). Hurricane-related exposure experiences and stressors, other life events, and social support: concurrent and prospective impact on children's persistent posttraumatic stress symptoms. *Journal of Consulting and Clinical Psychology, 78*(6), 794.

Leahy, E., & Gradisar, M. (2012). Dismantling the bidirectional relationship between paediatric sleep and anxiety. *Clinical Psychologist, 16*(1), 44-56.

LeBourgeois, M. K., Giannotti, F., Cortesi, F., Wolfson, A. R., & Harsh, J. (2005). The relationship between reported sleep quality and sleep hygiene in Italian and American adolescents. *Pediatrics, 115*(1 0), 257-265.

Lebowitz, E. R., Scharfstein, L. A., & Jones, J. (2014). Comparing family accommodation in pediatric obsessive-compulsive disorder, anxiety disorders, and nonanxious children. *Depression and Anxiety, 31*(12), 1018-1025.

Liberty, K. (2017). *Reducting stress in schools: Information for principals, teachers and parents about stressed children in disaster-struck communities and how to help them in difficult times*. National Library of New Zealand.ISBN 9780473425203. Retrieved from: https://archive.org/details/ReducingStressInSchools2017

Liberty, K., Hooper, L., & Adams, L. (2016b). *Juniors settling into and learning in primary school: parent report*. University of Canterbury. Unpublished raw data

Liberty, K., Tarren-Sweeney, M., Macfarlane, S., Basu, A., & Reid, J. (2016a). Behavior Problems and Post-traumatic Stress Symptoms in Children Beginning School: A Comparison of Pre-and Post-Earthquake Groups. *PLOS Currents Disasters*.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry* (Vol. 75): Sage.

Liu, X., Uchiyama, M., Okawa, M., & Kurita, H. (2000). Prevalence and correlates of self-reported sleep problems among Chinese adolescents. *Sleep: Journal of Sleep Research & Sleep Medicine*.

Lucki, I. (1998). The spectrum of behaviors influenced by serotonin. *Biological Psychiatry, 44*(3), 151-162.

McEwen, B. S. (2007). Physiology and neurobiology of stress and adaptation: central role of the brain. *Physiological Reviews, 87*(3), 873-904.

McFarlane, A. C. (1987). Posttraumatic phenomena in a longitudinal study of children following a natural disaster. *Journal of the American Academy of Child & Adolescent Psychiatry, 26*(5), 764-769.

McLellan, E., MacQueen, K. M., & Neidig, J. L. (2003). Beyond the qualitative interview: Data preparation and transcription. *Field Methods, 15*(1), 63-84.

Meltzer, L. J., & Mindell, J. A. (2007). Relationship between child sleep disturbances and maternal sleep, mood, and parenting stress: a pilot study. *Journal of Family Psychology, 21*(1), 67.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook.* (2nd ed.). Sage Publications.

Mindell, J. A., & Meltzer, L. J. (2008). Behavioural sleep disorders in children and adolescents. *Annuals Academy of Medicine, 37*(8), 722-728.

Mindell, J. A., Meltzer, L. J., Carskadon, M. A., & Chervin, R. D. (2009). Developmental aspects of sleep hygiene: findings from the 2004 National Sleep Foundation Sleep in America Poll. *Sleep Medicine, 10*(7), 771-779.

Mindell, J. A., Sadeh, A., Kohyama, J., & How, T. H. (2010). Parental behaviors and sleep outcomes in infants and toddlers: a cross-cultural comparison. *Sleep Medicine, 11*(4), 393-399.

Moore, M. (2012). Behavioral sleep problems in children and adolescents. *Journal of Clinical Psychology in Medical Settings, 19*(1), 77-83.

Moretti, F., van Vliet, L., Bensing, J., Deledda, G., Mazzi, M., Rimondini, M., . . . Fletcher, I. (2011). A standardized approach to qualitative content analysis of focus group discussions from different countries. *Patient Education and Counseling, 82*(3), 420-428.

Neria, Y., Nandi, A., & Galea, S. (2008). Post-traumatic stress disorder following disasters: a systematic review. *Psychological Medicine, 38*(4), 467-480.

Nixon, G. M., Thompson, J. M., Han, D. Y., Becroft, D. M., Clark, P. M., Robinson, E., . . . Mitchell, E. A. (2009). Falling asleep: the determinants of sleep latency. *Archives of Disease in Childhood, 94*(9), 686-689.

Noffsinger, M. A., Pfefferbaum, B., Pfefferbaum, R. L., Sherrieb, K., & Norris, F. H. (2012). The burden of disaster: Part I. Challenges and opportunities within a child's social ecology. *International Journal of Emergency Mental Health, 14*(1), 3.

Norris, F. H., Friedman, M. J., Watson, P. J., Byrne, C. M., Diaz, E., & Kaniasty, K. (2002). 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001. *Psychiatry: Interpersonal and Biological Processes, 65*(3), 207-239.

O'Connor, T. G., Caprariello, P., Blackmore, E. R., Gregory, A. M., Glover, V., Fleming, P., & Team, A. S. (2007). Prenatal mood disturbance predicts sleep problems in infancy and toddlerhood. *Early Human Development, 83*(7), 451-458.

Owens, J. A., Spirito, A., & McGuinn, M. (2000). The Children's Sleep Habits Questionnaire (CSHQ): psychometric properties of a survey instrument for school-aged children. *Sleep, 23*(8), 1043-1052.

Owens, J. A., Spirito, A., McGuinn, M., & Nobile, C. (2000). Sleep habits and sleep disturbance in elementary school-aged children. *Journal of Developmental & Behavioral Pediatrics, 21*(1), 27-36.

Patel, V. L., Arocha, J. F., & Zhang, J. (2005). Thinking and reasoning in medicine. *The Cambridge Handbook of Thinking and Reasoning, 14*, 727-750.

Peterman, J. S., Carper, M. M., & Kendall, P. C. (2015). Anxiety disorders and comorbid sleep problems in school-aged youth: review and future research directions. *Child Psychiatry & Human Development, 46*(3), 376-392.

Pine, D. S., & Cohen, J. A. (2002). Trauma in children and adolescents: Risk and treatment of psychiatric sequelae. *Biological Psychiatry, 51*(7), 519-531.

Piyasil, V., Ketuman, P., Plubrukarn, R., Pacharakaew, S., Dumrongphol, H., & Rungsri, S. (2007). Psychiatric problems in Children and Adolescents at 1 year after the Tsunami Disaster. *Journal of Pediatrics, 46*, 36-41.

Pizarro, J. M., Lumley, L. A., Medina, W., Robison, C. L., Chang, W. E., Alagappan, A., . . . Mark, B. (2004). Acute social defeat reduces neurotrophin expression in brain cortical and subcortical areas in mice. *Brain Research, 1025*(1), 10-20.

Polit, D. F., & Beck, C. T. (2012). *Nursing Research: Generating and Assessing Evidence for Nursing Practise*. Philadelphia: Lippincott Williams & Wilkins.

Proctor, L. J., Fauchier, A., Oliver, P. H., Ramos, M. C., Rios, M. A., & Margolin, G. (2007). Family context and young children's responses to earthquake. *Journal of Child Psychology and Psychiatry, 48*(9), 941-949.

Rapee, R. M. (2012). Family factors in the development and management of anxiety disorders. *Clinical Child and Family Psychology Review, 15*(1), 69-80.

Ressler, K. J., & Nemeroff, C. B. (2000). Role of serotonergic and noradrenergic systems in the pathophysiology of depression and anxiety disorders. *Depression and Anxiety, 12*(S1), 2-19.

Richman, N., Douglas, J., Hunt, H., Lansdown, R., & Levere, R. (1985). Behavioural methods in the treatment of sleep disorders—a pilot study. *Journal of Child Psychology and Psychiatry, 26*(4), 581-590.

Ronan, K. R., Alisic, E., Towers, B., Johnson, V. A., & Johnston, D. M. (2015). Disaster preparedness for children and families: a critical review. *Current Psychiatry Reports, 17*(7), 58.

Sadeh, A. (1996). Stress, trauma, and sleep in children. *Child and Adolescent Psychiatric Clinics of North America, 5*(3), 685-700.

Sadeh, A. (2005). Cognitive–behavioral treatment for childhood sleep disorders. *Clinical Psychology Review, 25*(5), 612-628.

Sadeh, A., Gruber, R., & Raviv, A. (2002). Sleep, neurobehavioral functioning, and behavior problems in school-age children. *Child development, 73*(2), 405-417.

Sadeh, A., Mindell, J., & Rivera, L. (2011). "My child has a sleep problem": a cross-cultural comparison of parental definitions. *Sleep Medicine, 12*(5), 478-482.

Sadeh, A., Mindell, J. A., Luedtke, K., & Wiegand, B. (2009). Sleep and sleep ecology in the first 3 years: a web-based study. *Journal of Sleep Research, 18*(1), 60-73.

Sadeh, A., Raviv, A., & Gruber, R. (2000). Sleep patterns and sleep disruptions in school-age children. *Developmental Psychology, 36*(3), 291.

Sadeh, A., Tikotzky, L., & Scher, A. (2010). Parenting and infant sleep. *Sleep Medicine Reviews, 14*(2), 89-96.

Sailer, U., Robinson, S., Fischmeister, F. P. S., König, D., Oppenauer, C., Lueger-Schuster, B., . . . Bauer, H. (2008). Altered reward processing in the nucleus accumbens and mesial prefrontal cortex of patients with posttraumatic stress disorder. *Neuropsychologia, 46*(11), 2836-2844.

Saks, M., & Allsop, J. (2007). *Researching Hhalth: Qualitative, quantitative and mixed methods*: Sage.

Salkovskis, P. M. (1991). The importance of behaviour in the maintenance of anxiety and panic: A cognitive account. *Behavioural and Cognitive Psychotherapy, 19*(1), 6-19.

Scheeringa, M. S., Zeanah, C. H., Myers, L., & Putnam, F. W. (2003). New findings on alternative criteria for PTSD in preschool children. *Journal of the American Academy of Child & Adolescent Psychiatry, 42*(5), 561-570.

Schwartz-Mette, R. A., & Rose, A. J. (2012). Co-rumination mediates contagion of internalizing symptoms within youths' friendships. *Developmental Psychology, 48*(5), 1355.

Sciberras, E., Song, J. C., Mulraney, M., Schuster, T., & Hiscock, H. (2017). Sleep problems in children with attention-deficit hyperactivity disorder: associations with parenting style and sleep hygiene. *European Child & Adolescent Psychiatry, 26*(9), 1129-1139.

Shaw. (2000). Children, adolescents and trauma. *Psychiatric Quarterly, 71*(3), 227-243.

Shaw, J., Espinel, Z., & Shultz, J. M. (2012). *Care of children exposed to the traumatic effects of disaster*. Arlington, VA: American Psychiatric Publishing.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information, 22*(2), 63-75.

Short, M. A., Gradisar, M., Wright, H., Lack, L. C., Dohnt, H., & Carskadon, M. A. (2011). Time for bed: parent-set bedtimes associated with improved sleep and daytime functioning in adolescents. *Sleep, 34*(6), 797-800.

Siever, L. J. (2008). Neurobiology of aggression and violence. *American Journal of Psychiatry, 165*(4), 429-442.

Silverman, W. K., & La Greca, A. M. (2002). Children experiencing disasters: Definitions, reactions, and predictors of outcomes. In A. M. La Greca, W. K. Silverman, E. M. Vernberg & M. C. Roberts (Eds.), *Helping children cope with disasters and terrorism* (pp. 11-33). Washington, DC: American Psychological Association

Smits, M. G., van der Heijden, K., Meijer, A. M., Coenen, A. M., & Kerkhof, G. A. (2003). Melatonin improves health status and sleep in children with idiopathic chronic sleep-onset insomnia: a randomized placebo-controlled trial. *Journal of the American Academy of Child & Adolescent Psychiatry, 42*(11), 1286-1293.

Spruyt, K., O'brien, L. M., Cluydts, R., Verleye, G. B., & Ferri, R. (2005). Odds, prevalence and predictors of sleep problems in school-age normal children. *Journal of Sleep Research, 14*(2), 163-176.

Sroufe, L. A., & Rutter, M. (1984). The domain of developmental psychopathology. *Child Development*, 17-29.

Stewart, A. (2016, February 26). More Canterbury children scared of wind, rather than aftershocks. *Stuff.* Retrieved from: https://www.stuff.co.nz/national/health/77278930/More-Canterbury-children-scared-of-wind-rather-than-aftershocks

Stoléru, S., Nottelmann, E. D., Belmont, B., & Ronsaville, D. (1997). Sleep problems in children of affectively ill mothers. *Journal of Child Psychology and Psychiatry, 38*(7), 831-841.

Terasaka, A., Tachibana, Y., Okuyama, M., & Igarashi, T. (2015). Post-traumatic stress disorder in children following natural disasters: a systematic review of the long-term follow up studies. *International Journal of Child, Youth and Family Studies, 6*(1), 111-133.

Terr, L. C. (1991). Childhood traumas: An outline and overview. *American Jouranal of Psychiatry, 148*, 10-20.

Thapar, A., Cooper, M., Eyre, O., & Langley, K. (2013). Practitioner review: what have we learnt about the causes of ADHD? *Journal of Child Psychology and Psychiatry, 54*(1), 3-16.

Thoits, P. A. (1995). Stress, coping, and social support processes: Where are we? What next? *Journal of Health and Social Behavior*, 53-79.

Thordardottir, E. B., Hansdottir, I., Valdimarsdottir, U. A., Shipherd, J. C., Resnick, H., & Gudmundsdottir, B. (2016). The manifestations of sleep disturbances 16 years post-trauma. *Sleep, 39*(8), 1551-1554.

Thunstrom, M. (1999). Severe sleep problems among infants: family and infant characteristics. *Ambulatory Child Health, 5*, 27.

Trickey, D., Siddaway, A. P., Meiser-Stedman, R., Serpell, L., & Field, A. P. (2012). A meta-analysis of risk factors for post-traumatic stress disorder in children and adolescents. *Clinical Psychology Review, 32*(2), 122-138.

Ularntinon, S., Piyasil, V., Ketumarn, P., Sitdhiraksa, N., Pityaratstian, N., Lerthattasilp, T., . . . Teeranukul, S. (2008). Assessment of psychopathological consequences in children at 3 years after tsunami disaster. *Journal of the Medical Association of Thailand, 91*, 69-S75.

Usami, M., Iwadare, Y., Kodaira, M., Watanabe, K., Aoki, M., Katsumi, C., . . . Harada, M. (2013). Sleep duration among children 8 months after the 2011 Japan earthquake and tsunami. *PLOS One, 8*(5), 1-6.

van Geijlswijk, I. M., Korzilius, H. P., & Smits, M. G. (2010). The use of exogenous melatonin in delayed sleep phase disorder: a meta-analysis. *Sleep, 33*(12), 1605-1614.

van Liempt, S. (2012). Sleep disturbances and PTSD: a perpetual circle? *European Journal of Psychotraumatology, 3*(1), 19142.

van Wyk, M., Thomas, K. G., Solms, M., & Lipinska, G. (2016). Prominence of hyperarousal symptoms explains variability of sleep disruption in posttraumatic stress disorder. *Psychological Trauma: Theory, Research, Practice, and Policy, 8*(6), 688.

Vertue, F. M., & Haig, B. D. (2008). An abductive perspective on clinical reasoning and case formulation. *Journal of Clinical Psychology, 64*(9), 1046-1068.

Vogel, J. M., & Vernberg, E. M. (1993). Part 1: Children's psychological responses to disasters. *Journal of Clinical Child Psychology, 22*(4), 464-484.

Wang, C.-W., Chan, C. L., & Ho, R. T. (2013). Prevalence and trajectory of psychopathology among child and adolescent survivors of disasters: a systematic review of epidemiological studies across 1987–2011. *Social Psychiatry and Psychiatric Epidemiology, 48*(11), 1697-1720.

Wasserstein, S. B., & La Greca, A. M. (1998). Hurricane Andrew: Parent conflict as a moderator of children's adjustment. *Hispanic Journal of Behavioral Sciences, 20*(2), 212-224.

Weems, C. F., & Overstreet, S. (2008). Child and adolescent mental health research in the context of Hurricane Katrina: An ecological needs-based perspective and introduction to the special section. *Journal of Clinical Child & Adolescent Psychology, 37*(3), 487-494.

Wolfson, A. R., & Carskadon, M. A. (2003). Understanding adolescent's sleep patterns and school performance: a critical appraisal. *Sleep Medicine Reviews, 7*(6), 491-506.

World Health Organization. (1992). Psychosocial consequences of disasters: prevention and management. Retrieved from: http://apps.who.int/iris/bitstream/10665/58986/1/WHO_MNH_PSF_91.3_REV.1.pdf

Xu, Z., Su, H., Zou, Y., Chen, J., Wu, J., & Chang, W. (2012). Sleep quality of Chinese adolescents: distribution and its associated factors. *Journal of Paediatrics and Child Health, 48*(2), 138-145.

Yoo, S.-S., Gujar, N., Hu, P., Jolesz, F. A., & Walker, M. P. (2007). The human emotional brain without sleep—a prefrontal amygdala disconnect. *Current Biology, 17*(20), R877-R878.

Zhang, Zhu, S., Du, C., & Zhang, Y. (2015b). Posttraumatic stress disorder and somatic symptoms among child and adolescent survivors following the Lushan earthquake in China: A six-month longitudinal study. *Journal of Psychosomatic Research, 79*(2), 100-106.

Zhou, X., Wu, X., An, Y., & Fu, F. (2014). Longitudinal relationships between posttraumatic stress symptoms and sleep problems in adolescent survivors following the Wenchuan earthquake in China. *PLOS One, 9*(8), 1-7.

Zimmerman, F. J. (2008). Children's Media Use and Sleep Problems: Issues and Unanswered Questions. Research Brief. *Henry J. Kaiser Family Foundation*.

Zoellner, L. A., Bedard-Gilligan, M. A., Jun, J. J., Marks, L. H., & Garcia, N. M. (2013). The evolving construct of posttraumatic stress disorder (PTSD): DSM-5 criteria changes and legal implications. *Psychological Injury and Law, 6*(4), 277-289.

Appendices

Appendix A: Human Ethics Committee Approval

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2017/51

3 July 2017

Sophie Hallam
School of Health Sciences
UNIVERSITY OF CANTERBURY

Dear Sophie

The Human Ethics Committee advises that your research proposal "An Ecological-formulation of Children's Sleep Problems After the Canterbury Earthquakes" has been considered and approved.

Please note that this approval is subject to the incorporation of the amendments you have provided in your email of 27th June 2017.

Best wishes for your project.

Yours sincerely

R. Robinson

pp.

Associate Professor Jane Maidment
Chair
University of Canterbury Human Ethics Committee

Appendix B: Human Ethics Committee Approval for Amendment 1

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Rebecca Robinson
Telephone: +64 03 369 4588, Extn 94588
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2017/51 Amendment 1

30 August 2017

Sophie Hallam
School of Health Sciences
UNIVERSITY OF CANTERBURY

Dear Sophie

Thank you for your request for an amendment to your research proposal "An Ecological-formulation of Children's Sleep Problems After the Canterbury Earthquakes" as outlined in your email dated 28th August 2017.

I am pleased to advise that this request has been considered and approved by the Human Ethics Committee.

Yours sincerely

R. Robinson

pp.

Associate Professor Jane Maidment
Chair, Human Ethics Committee

Appendix C: Letter to Parents

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Date
Dear [parent]

Thank you very much for your continued participation in the Juniors Settling In and Learning Study. As part of this study, you have previously sent me information that _____ has been having some problems with sleeping.

One of my students, Ms. Sophie Hallam, is beginning her masters research, looking in more detail at the sleep problems and how the child and families are coping with these problems. An expert in children's sleep, Associate Professor Karyn France, is co-supervising Sophie's study.

If your child is still having issues with sleep such as night waking, trouble falling asleep, or problems going to bed, etc., then I am inviting you and your child to be one of five families in Sophie's study, which will involve interviews. After the interviews, you may receive information about how to improve your child's sleep, or have an intervention put together to try and address your child's current sleep problems if you wish it.

Your participation in Sophie's study will help us prepare information about sleep for all of the families in our broader study.

If you choose to volunteer you also have the right to withdraw at any time without penalty. For more information about this study please contact Sophie Hallam by phone (027-781-2542), or email (sophie.hallam@pg.canterbury.ac.nz), or contact me, kathleen.liberty@canterbury.ac.nz (027-349-0645).

We would be grateful if you could let us know within 1 week?

Many thanks for your consideration,

Kathleen Liberty, Ph.D.
Associate Professor
Principal Investigator
Juniors Settling into School Study

Appendix D: Participant Information Sheet

School of Health Sciences
Phone: 0277812542
Email: sophie.hallam@pg.canterbury.ac.nz

An Ecological Formulation of Children's Sleep Problems after the Canterbury Earthquakes

Information Sheet

Dear [name of parent/guardian],

My name is Sophie Hallam and I am a Child and Family Psychology Master's student at the University of Canterbury. I am conducting research regarding children's sleep problems in relation to the Canterbury earthquakes and am interested in hearing about your experiences. While your help will be greatly appreciated, your participation in the study is completely voluntary. Whether you decide to volunteer, or not, will not influence your relationship with the researchers involved in the study, or with the University of Canterbury, either now, or in the future

This research will explore the various factors that may be contributing to your child's current sleep problems following the Canterbury earthquakes, as well as how you may have tried to solve these problems. This study will involve an exploration of current sleeping problems, relevant family history, and experiences of yourself and your child during the first earthquakes, and in the following years in order to try and understand these sleeping problems. Based on the information gathered, an intervention can be put together to try and address the current sleep problems if you wish it.

Involvement in this study

If you choose to take part in this study your involvement will include completing a parent sleep diary; participating in an interview; and completing further assessment if necessary, with your agreement depending on the outcomes of the interviews.

The sleep diary is a simple tool which will be used to gather information about your child's sleep. It will need to be completed over the course of 1 week and will involve recording when

your child goes to bed and falls asleep, as well as any interactions between yourself and your child during the bedtime and sleep period. The sleep diary will be provided and will take approximately 10 minutes to complete each day.

With consent, an unobtrusive camera will be set up in your child's bedroom for 2 nights during the same week as the sleep diary. This is to support information gathered by the sleep diary and interviews.

You will also participate in an interview which will allow for more information to be gathered about you and your family's earthquake experiences, and experiences with your child's sleep problems.

The interview will be scheduled around your availability and will take approximately 1 hour over one or two sessions. To ensure the accuracy of my notes, sessions will be video-recorded. After your own interview, we can discuss if there is anything specific you would like me to cover with your child. The interview with your child will not cover earthquake related subjects, but will focus on their perspective of their sleep. This interview will take up to 1 hour and will also be video-recorded to ensure the accuracy of my notes.

The interviews with yourselves and your child will be undertaken at the University of Canterbury's Pukemanu/ Dovedale Centre (Dovedale Ave) - or at another venue if this does not suit. After the interview, we will discuss whether any further information may be useful for us to gather and whether we can help in any way.

Risks and Benefits

Risks are minimal for this project; however, some questions may remind you of a distressing period in your lives. If you or your child feels emotional or upset, then you do not have to answer the questions. You or your child may also take a break or stop the interview if you need.

Benefits of this study include that we may be able to provide some help managing your child's sleep, based on the information collected. The findings from this study may also benefit children and families who are in similar circumstances to yourselves.

Participants' Rights

Participation is voluntary and you have the right to withdraw from the project at any time without penalty. If you choose to withdraw, I will use my best endeavours to remove any of the information relating to you from the project, including any final publication, provided that this remains practically achievable.

You have the right to omit or refuse to answer or respond to any question that is asked of you without penalty. You will also be given the opportunity to view a copy of the interview transcripts of yourself and your child. These will be sent via email to participants, or post if that is preferred. You have the right to request that any information be omitted if, for

example, you feel that it may identify you or if it would cause distress if it were to be included.

Once information from all participants has been pooled together it will no longer to be possible to withdraw information. Before this point occurs, you will be made aware and given plenty of opportunity to withdraw information if you wish to.

You may indicate to the researcher on the consent form provided if you would like to receive a copy of the summary of results of the project.

Confidentiality/Anonymity

The results of the project may be published, but you can be assured of the complete confidentiality of data gathered; neither your identity, nor that of your child's will be made public without your consent. To ensure anonymity and confidentiality the only people who will have access to this data will be myself and my two supervisors. The data will be securely stored, under code numbers, not names, in a locked cabinet in my office which will also be kept locked when not in use. Data will be destroyed after 5 years.

Since this research involves only a few families, the results will be pooled in the final publication to ensure no individual factors can be traced back to any family in particular. These measures are to ensure your privacy, as a thesis is a public document and will be available through the UC Library.

For further information

This project is being carried out as a requirement for the Child and Family Psychology programme at the University of Canterbury under the School of Health Sciences, by Sophie Hallam under the supervision of Associate Professors Karyn France (karyn.france@canterbury.ac.nz), and Kathleen Liberty (kathleen.liberty@canterbury.ac.nz). Please feel free to contact them to discuss any concerns you may have about participating in this project.

Complaints Procedure

This project has been reviewed and approved by the University of Canterbury Educational Research Human Ethics Committee. Participants should address complaints to The Chair, Educational Research Human Ethics Committee, University of Canterbury, Private Bad 4800, Christchurch (humanethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to complete the consent form provided.

Yours Sincerely,

Sophie Hallam.

Appendix E: Parental/Guardian Consent Form

School of Health Sciences
Phone: 0277812542
Email: sophie.hallam@pg.canterbury.ac.nz

Consent Form for Parents and Guardians

Please read the following statements:

- ☐ I confirm that I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand the information sheet provided, and understand what is required of me if I agree to take part in this research.
- ☐ I understand that participation is voluntary and that I may withdraw at any time without penalty.
- ☐ I understand that the interviews will be video-recorded to ensure accuracy of data.
- ☐ I understand that I will be given the opportunity to read a copy of the interview transcripts of myself and my child's.
- ☐ I understand that there will be a camera in my child's room for 2 nights to gather data that might otherwise ay be missed.
- ☐ I understand that I can withdraw information I have provided at any time during the study, and that I can refuse to respond or answer any questions asked without penalty.
- ☐ I understand that any information provided will be kept confidential to the researcher and two supervisors of this project. The only exception will be if the primary researcher thinks my own safety, my child's safety, or someone else's safety is at risk. Then the primary researcher will be required to inform her supervisors who will then contact the appropriate services.
- ☐ I understand that to the best of the researcher's ability, any published or reported results will not identity the participants. I understand that a thesis is a public document and will be available through the UC Library.
- ☐ I understand that all information collected for this study will be securely stored under code numbers in a locked cabinet in a locked facility, or will be in a password protected electronic form, and that all data will be destroyed after 5 years.
- ☐ I understand any risks associated with taking part in this study and how they will be managed.
- ☐ I understand that I am able to contact the researcher (sophie.hallam@pg.canterbury.ac.nz) or supervisors (karyn.france@canterbury.ac.nz; kathleen.liberty@canterbury.ac.nz) for further information, and that if I have any

complaints I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you would like a summary of the results of this project please tick here: ☐

By signing below, I agree to participate in this research project (by signing the consent form I indicate that I understand and agree to the research conditions). I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

Name:_____ Signed:_____ Date:_____

Name:_____ Signed:_____ Date:_____

Email address: _____

Yours Sincerely,

Sophie Hallam.

Appendix F: Parental/Guardian Consent Form for Child

School of Health Sciences
Phone: 0277812542
Email: sophie.hallam@pg.canterbury.ac.nz

Parental/Guardian Consent Form for Child

Please read the following statements:

- ☐ I confirm that my child has received a full explanation of this project and has had the opportunity to ask questions
- ☐ I confirm that my child understands this project and what is required of them if they agree to take part in this research
- ☐ I confirm that my child understands that participation is voluntary and that he/she may withdraw at any time without penalty
- ☐ I confirm that my child understands that the interview will be video-recorded in order to ensure accuracy of data
- ☐ I confirm that my child understands that they can request to see a copy of their interview transcript
- ☐ I confirm that my child understands that there will be a camera in their room for 2 nights to gather data that otherwise may be missed
- ☐ I confirm that my child understands that he/she can withdraw information they have provided at any time during the study, and that he/she can refuse to respond or answer any questions asked without penalty
- ☐ I confirm that my child understands that any information provided will be kept confidential to the researcher and two supervisors of this project. The only exception will be if the primary researcher thinks that the parent/guardian's, child's, or someone else's safety is at risk. Then the primary researcher will be required to inform her supervisors who will then contact the appropriate services
- ☐ I confirm that my child understands that, to the best of the researcher's ability, any published or reported results will not identity the participants. My child understands that a thesis is a public document and will be available through the UC Library
- ☐ I confirm that my child understands that all information collected for this study will be securely stored under code numbers in a locked cabinet in a locked

facility, or will be in a password protected electronic form. and that all data will be destroyed after 5 years.

- ☐ I confirm that my child understands any risks associated with taking part in this study and how they will be managed
- ☐ I confirm that my child understands that they are able to ask for further information, and that they can make complaints if need be. If I am unable to answer my child's questions I am able to contact the researcher (sophie.hallam@pg.canterbury.ac.nz) or supervisors for further information, and that if my child has any complaints I can contact the Chair of the University of Canterbury Educational Research Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)

By signing below, I give permission for my child to participate in this research project (by signing the consent form I indicate that I understand and agree to the research conditions my child will be involved in).

Name of child: _____

Name of parent/guardian:_____Signed:_____

Name of parent/guardian:_____Signed:_____

Date:_____

Yours Sincerely,

Sophie Hallam.

Appendix G: Child Assent Form

School of Health Sciences
Phone: 0277812542
Email: sophie.hallam@pg.canterbury.ac.nz

Child Assent Form

My name is Sophie Hallam and I am from the University of Canterbury. We are asking you to take part in a research study because we want to learn more about your sleep.

Things we are asking you to do

Your parents will need to fill out a "sleep diary" for 1 week which tells us things like when you go to bed and fall asleep. But we also want to know what you think of your own sleep so if it is okay with you, we will get you to fill out an easy form that is just for you. With permission, a video recorder will also be set up in your room for 2 nights to catch anything about your sleep that we may have missed.

I will be talking to your mum and dad about your sleep but I also want to talk to you about your sleep as well. This will just be a nice friendly talk about what your sleep has been like for the last few years and what you think about your sleep. This will take around 1 hour and will be video-recorded to make sure that I do not miss anything we have talked about.

Do I have to be in this study?

You do not have to do this if you do not want to, it is up to you. If you say yes now, you can still change your mind later and no one will be upset about this.

Are there good things and bad things about being in this study?

Hopefully we will be able to learn more about your sleep, and we might be able to make it better too. Remember that during your talk with me you do not have to answer any questions if you do not want to, and we can take a break or stop the talk if you want to.

What will you do with the information about me?

The only people I will talk to about what we have talked about will be your parents and all information about you will be locked up so no one else can read it.

If you want to stop doing this at any time, your parents can talk to me and I will not use any information you have given me. You will not get in trouble for doing this.

Questions

If you have any questions about this then you can ask your parents, and if they cannot answer them for you then your parents can ask.

Agreement

By signing your name at the bottom of this form, it means that you want to do this.

Your name: _____Date: _____

Yours Sincerely,

Sophie Hallam.

Appendix H: Sleep Diary

Sleep Diary

Child's Name:

	Date:	Monday:	Tuesday:	Wednesday:	Thursday:	Friday:	Saturday:	Sunday:
Daytime sleep	Setting (where fell asleep)							
	Time asleep							
	Time awake							
Night-time sleep	Setting (where fell asleep)							
	Time put to bed							
	Frequency of Curtain calls*							
	Curtain calls after put to bed (Describe each)							
	Your responses to each curtain call (Describe each)							
	Best estimate of time asleep							

		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1st Nigh time awakening	Time & Duration of awakening	_____ mins	_____mins	_____ mins	_____ mins	_____ mins	_____ mins	_____ mins
	Behaviour while awake (Describe)							
	Your responses (Describe)							
		Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
2nd Nigh time awakening	Time & Duration of awakening	_____ mins	_____mins	_____ mins	_____ mins	_____ mins	_____ mins	_____ mins
	Behaviour while awake (Describe)							
	Your responses (Describe)							

		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
3rd Nigh time awakening	Time & Duration of awakening	_____ mins	___mins	_____ mins	_____ mins	_____ mins	_____ mins	_____ mins
	Behaviour while awake (Describe)							
	Your responses (Describe)							
Time awake in the morning								

- Curtain calls: Any behaviour such as leaving the bed (or bedroom) or calling parents into the room, between the time of being put to bed and falling asleep

Notes:

Appendix I: Child's Sleep Habits Questionnaire

Child's Sleep Habits Questionnaire (pre-school and school-aged children)

The following statements are about your child's sleep habits and possible difficulties with sleep. Think about the past week in your child's life when answering the questions. If last week was unusual for a specific reason (such as your child had an ear infection and did not sleep well or the TV set was broken) choose the most recent typical week.

Answer USUALLY if something occurs **5 or more times** in a week.

Answer SOMETIMES if it occurs **2-4 times** in a week.

Answer RARELY if something occurs **never or 1 time** during a week.

Indicate whether or not the sleep habit is a problem by circling "Yes", "No," or "not applicable (N/A)".

Write in child's bedtime: _____ Write in child's usual wake time: _____

Child's usual amount of sleep each night (no naps): _____hours and _____minutes

Child's usual amount of sleep each day (naps): _____hours and _____minutes

	1 Usually (5-7)	2 Sometimes (2-4)	3 Rarely (0-1)	Problem?		
1. Child goes to bed at the same time at night	□	□	□	Yes	No	N/A
2. Child falls asleep alone in own bed	□	□	□	Yes	No	N/A
3. Child falls asleep within 20 minutes after going to bed	□	□	□	Yes	No	N/A
4. Child sleeps the right amount	□	□	□	Yes	No	N/A
5. Child sleeps about the same amount each day	□	□	□	Yes	No	N/A

6. Child wakes up by him/herself	□	□	□	Yes	No	N/A

Child has appeared very sleepy or fallen asleep during the following (check all that apply):

	0 Not Sleepy	1 Very Sleepy	2 Falls Asleep
7. Watching TV	□	□	□
8. Riding in a car	□	□	□

	3 Usually (5-7)	2 Sometimes (2-4)	1 Rarely (0-1)	Problem?		
9. Child falls asleep in parent's or sibling's bed	□	□	□	Yes	No	N/A
10. Child struggles at bedtime (cries, refuses to stay in bed, etc.)	□	□	□	Yes	No	N/A
11. Child needs parent in the room to fall asleep	□	□	□	Yes	No	N/A
12. Child is afraid of sleeping alone	□	□	□	Yes	No	N/A
13. Child sleeps too little	□	□	□	Yes	No	N/A
14. Child is afraid of sleeping in the dark	□	□	□	Yes	No	N/A
15. Child has trouble sleeping away from home (visiting relatives, vacation)	□	□	□	Yes	No	N/A
16. Child moves to someone else's bed during the night (parent, sibling, etc.)	□	□	□	Yes	No	N/A
17. Child awakens once during the night	□	□	□	Yes	No	N/A
18. Child awakens more than once during the night	□	□	□	Yes	No	N/A
Write the number of minutes a night waking usually lasts: _____						
19. Child talks during sleep	□	□	□	Yes	No	N/A

20. Child is restless and moves a lot during sleep	□	□	□	Yes	No	N/A
21. Child sleepwalks during the night	□	□	□	Yes	No	N/A
22. Child wets the bed at night	□	□	□	Yes	No	N/A
23. Child grind teeth during sleep (your dentist may have told you this)	□	□	□	Yes	No	N/A
24. Child awakens alarmed by a frightening dream	□	□	□	Yes	No	N/A
25. Child awakens during night screaming, sweating, and inconsolable	□	□	□	Yes	No	N/A
26. Child snores loudly	□	□	□	Yes	No	N/A
27. Child seems to stop breathing during sleep	□	□	□	Yes	No	N/A
28. Child snorts and/or gasps during sleep	□	□	□	Yes	No	N/A
29. Child wakes up in a negative mood	□	□	□	Yes	No	N/A
30. Adults or siblings wake up child	□	□	□	Yes	No	N/A
31. Child has difficulty getting out of bed in the morning	□	□	□	Yes	No	N/A
32. Child takes a long time to become alert in the morning	□	□	□	Yes	No	N/A
33. Child seems tired in the morning	□	□	□	Yes	No	N/A

Appendix J: Child's Self Report – Sleep Habits Questionnaire

SLEEP SELF REPORT

(Child's Form)

R = REVERSE SCORING

HIGHER SCORE INDICATES MORE PROBLEMATIC SLEEP

These questions are about your sleep. Please mark your answer to each question in the box. There are no right or wrong answers. Please ask if you do not understand a question. Thank you!

1. Who in your family sets the rules about when you go to bed?

☐Mum ☐Dad ☐You ☐Other: _____

2. Do you think you have trouble sleeping? ☐Yes ☐ No

3. Do you like to go to sleep? ☐Yes ☐No

	(3) Usually (5-7)/ week	(2) Sometimes (2-4)/ week	(1) Rarely (0-1)/ week/never
BEDTIME			
4. Do you go to bed at the same time every night on school nights? **(R)**	☐	☐	☐
5. Do you fall asleep in the same bed every night? **(R)**	☐	☐	☐
6. Do you fall asleep alone? **(R)**	☐	☐	☐
7. Do you fall asleep in parents', brothers', or sisters' bed?	☐	☐	☐
8. Do you fall asleep in about 20 minutes? **(R)**	☐	☐	☐
9. Do you fight with your parents about going to bed?	☐	☐	☐
10. Is it hard for you to go to bed?	☐	☐	☐

11. Are you ready for bed at your usual bedtime? **(R)**	☐	☐	☐
12. Do you have a special thing (doll, blanket, etc.) you bring to bed?	☐	☐	☐
13. Are you afraid of the dark?	☐	☐	☐
14. Are you afraid of sleeping alone?	☐	☐	☐
15. Do you stay up late when your parents think you are asleep?	☐	☐	☐

SLEEP BEHAVIOR

16. Do you think you sleep too little?	☐	☐	☐
17. Do you think you sleep too much?	☐	☐	☐
18. Do you wake up at night when your parents think you're asleep?	☐	☐	☐
19. Do you have trouble falling back to sleep if you wake up during the night?	☐	☐	☐
20. Do you have nightmares?	☐	☐	☐

	(3) Usually (5-7)/ week	**(2) Sometimes (2-4)/ week**	**(1) Rarely (0-1)/ week/never**
21. Does pain wake you up at night? Where is that pain?	☐	☐	☐
22. Do you sometimes go to someone's bed during the night? If yes, who? _____	☐	☐	☐

DAYTIME SLEEPINESS

23. Do you have trouble waking up in the morning?	☐	☐	☐
24. Do you feel sleepy during the day?	☐	☐	☐
25. Do you take naps during the day?	☐	☐	☐
26. Do you feel rested after a night's sleep? **(R)**	☐	☐	☐

Appendix K: Full List of Codes under Corresponding Themes

Themes and Codes
Early developmental adversities
Early infant breathing difficulties
Developmental delays and abnormalities
Premature birth
Possible predisposition to sleep problems
Consistent night-waking in infancy and sleep problems throughout early childhood
Difficult temperament
Maternal family history of enuresis
Behavioural Sleep problems
Bed-time resistance
Unwanted co-sleeping
Unwanted room sharing
Curtain calls
Erratic sleep patterns
Night waking
Delayed sleep onset
Sleep interfering behaviours
Excessive number of sleep aids
Parasomnias and anxiety-based sleep problems
Nocturnal Enuresis
Sleep talking
Nightmares
Fear of the dark
Hyperarousal
Child anxious without specific environmental variables for sleep onset

Child is a light sleeper

Child wellbeing and psychopathology

Attention deficit hyperactivity disorder

Oppositional defiance disorder

Low cognitive ability

High level of child worries

Child anxiety negatively impacts child's sleep

Negative impact of child's sleep problems on child wellbeing, development/education and rest

Emotional and behavioural problems

Oppositional and non-compliant behaviour

Emotional outbursts

Behaviour problems across settings

Unpredictable behaviour

Previous difficulties with peers due to child's emotional outbursts

Child's earthquake related externalizing and internalizing problems

Child's sleep problems onset or deterioration post-earthquake

Earthquakes trigger anxiety and a strong physiological response in child

Heightened startle and physiological response to building movement, storms and strong winds post-earthquake

Parental wellbeing and psychopathology

Parental depression and low mood

Maternal anxiety

Family stability depends on mother's mental stability

Maternal sleep problems and fatigue

Maternal depression related to fatigue from family conflict

Maternal post-traumatic stress disorder due to multiple traumas including the earthquakes

Maternal bi-polar disorder

History of paternal substance abuse

Negative impact of a history of parental child abuse

Parental stress

Negative impact of child's sleep problems on family wellbeing, rest and relationships

Emotional and behaviour problems stressful for family

Maternal anxiety due to the child's early developmental adversities

Maternal earthquake related anxiety about the child

Maternal earthquake related anxiety reinforced the child's anxiety

Maternal overprotectiveness

Maternal uncertainty about addressing child's earthquake related anxiety

Parental conflict

Pre and post-earthquake parental conflict related to mental health problems

Pre and post-earthquake conflict related to earthquake and other difficulties

Parental antisocial behaviour due to parental conflict

Parental conflict post-earthquake exacerbates child sleep problems

Children distressed over post-earthquake parental relationship conflict

Onset of child's aggressive behaviour following-parental conflict

Inconsistent custody arrangement unrelated to earthquakes

Parental responses to child's sleep and behaviour problems

Parents allow co-sleeping and encourage room sharing

Parents sleep on couch or direct child to couch as co-sleeping is aversive to parents

Parental use of physical comfort and soothing techniques after night-waking

Parents respond to curtain calls

Parental presence at sleep onset

Parental use of an earlier bed-time as punishment

Parental anger and reactive response to bed-time resistance

Inappropriate sleep hygiene practises

The families' earthquake experience and its immediate effects

Practical difficulties from earthquake disruption

Strong immediate parental emotional response

Parental focus on physical safety and preparedness

Child distressed, anxious and uncommunicative about the earthquake

Immediate negative effects of the earthquake on family sleep

Parental relationship strain from earthquake

Ongoing effects of the earthquakes

Practical challenges following the earthquake

Negative effects of the earthquake on parental wellbeing and family atmosphere

Earthquake compounded existing stressors and caused long-term difficulties

Family history of anxiety

Widespread availability of information

Mass media communicates future earthquake threats

Mass media provokes maternal anxiety by communicating the possibility of future earthquakes

Weather reports communicate upcoming storms

Upcoming storm reports trigger child anxiety and prompt room sharing

Greater flexibility of buildings

Greater flexibility of buildings trigger child physiological response

Peer difficulties unrelated to the earthquakes

Previous bullying impacted child's sleep and behaviour problems

Child bullied at previous school

Peers earthquake related anxiety

Peers strongly affected by earthquakes including anxiety

Earthquake effects on peers' influenced child's anxiety

Other non-earthquake related family stressors

Unsuccessful strategies for solving sleep problems

Stop-watch and countdown strategy to cue bed-time transition

Limit setting where child starts in own bed

Tried sleep chart

Parents redecorated child's bedroom

Internal parental cognitions about their child's sleep and behaviour problems

Mother initially believed child's age protected her from earthquake

Parents uncertain about reason for sleep problems, child's ability to return to sleep without assistance and long-term use of sleep and anxiety products

Parental normalization and attribution of sleep and behaviour problems as inherent to child or due to external sources unrelated to earthquake

Non-earthquake related exosystem stressors

Paternal physical injury, job loss and associated short-term financial hardship

Extended family physical health stressors and deaths

Long-term financial hardship which obstructs access to services

Negative earthquake related changes in the community

Maternal frustration due to sudden destruction and closure of community resources

Negative atmosphere of the city due to the impact of earthquake related stressors on the community

Maternal loss of friends due to relocation

Child able to sleep at times without disturbance

Child able to sleep in own bed

No sleep problems if fatigued

No sleep problems at other houses

Protective developmental factors

Smooth early development

High cognitive ability

No maternal concerns with child's development

Ability to form and maintain friendships

Strength of parental relationship

Helpful parent responses to child's sleep and behaviour problems

Child received Earthquake stress counselling

Mother communicates with child about emotional outbursts

Child avoids noise

Appropriate sleep hygiene practises

Beneficial strategies for minimizing child's arousal and anxiety

Parental engagement with medical services for child's sleep problems

Positive earthquake related changes in the community

Community markets post-earthquake

More supportive and peaceful community with improvement in the city atmosphere as the city was rebuilt

Maternal altruistic behaviour post-earthquake

Availability of adult support services

Parental engagement with support services improved parental wellbeing and mental health

Parental engagement with mental health and addiction services

Intermittent improvement in child's sleep problems over time

Sleep problems may be improving

Sleep problems fluctuate

Intermittent improvement in child's behaviour problems over time

Behaviour problems may be improving

Improvement in behaviour problems associated with improved sleep

Social support post-earthquake

Supportive friends and family

Supportive school teachers alleviated maternal anxiety

Childs smooth school transition related to supportive teachers

Community support post-earthquake

Adapting to an earthquake prone city

Children had to learn earthquake-safety procedures

Learning to live with earthquake damage

Stoicism in the aftermath